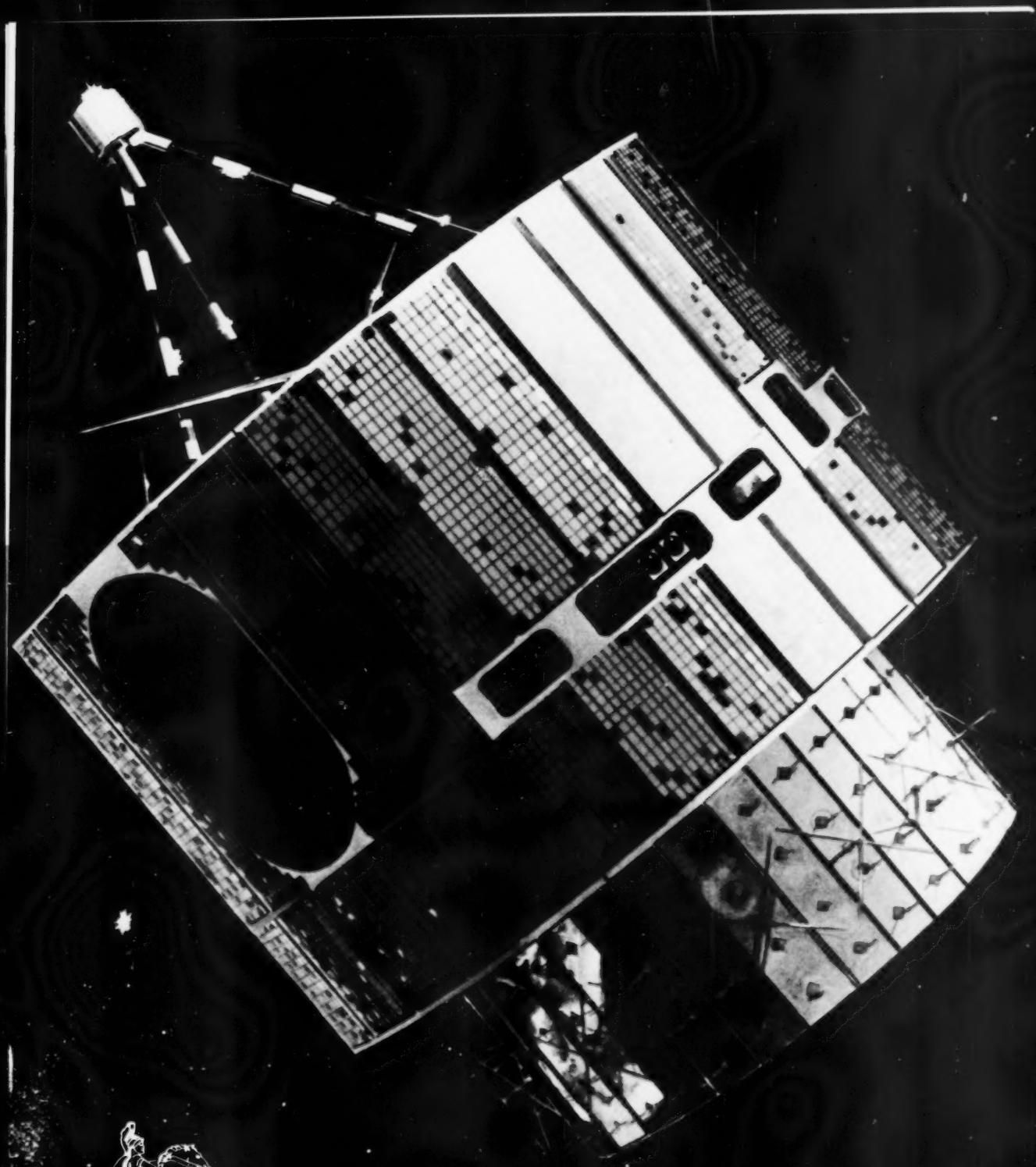

UNITED STATES ARMY

SEPTEMBER 1976

AVIATION DIGEST

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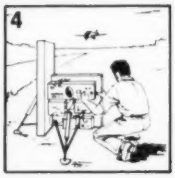

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ABOUT THE COVER

What does a satellite have to do with Army aviation? See page 1

The mission of the *U.S. ARMY AVIATION DIGEST* is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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ARMY AVIATION APPLICATIONS OF METEOROLOGICAL SATELLITES

Willis L. Webb, Ph.D.
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Meteorological Satellite Technical Area
Army Atmospheric Sciences Laboratory
U.S. Army Electronics Command
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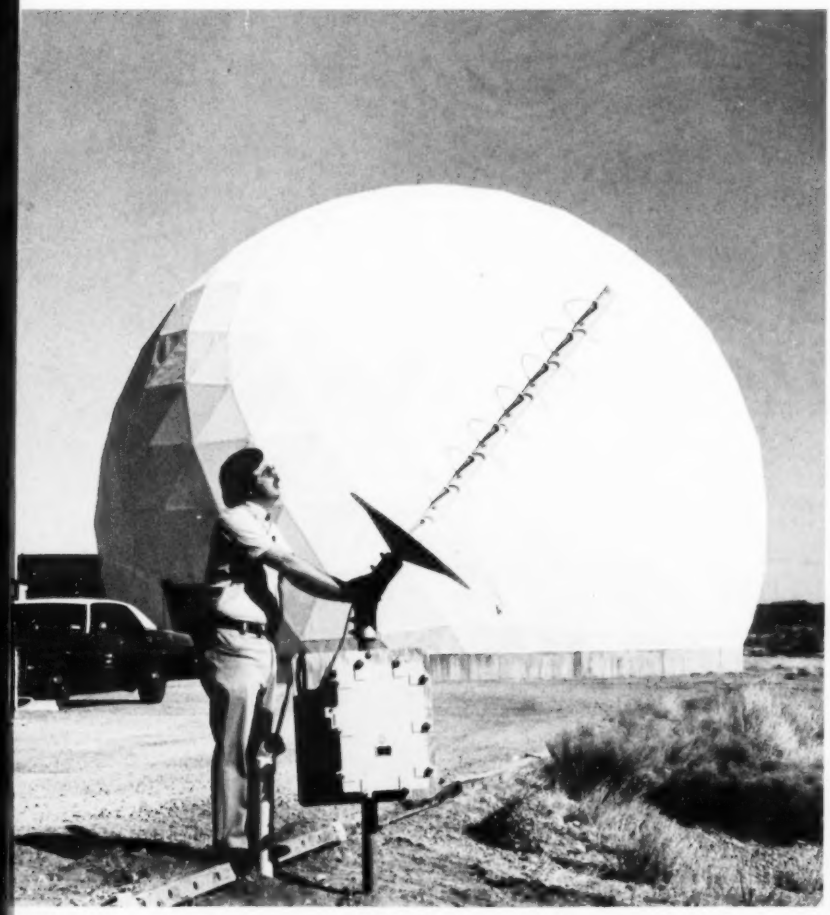


The SMS Direct Readout Ground Station (DRGS) at White Sands Missile Range used by the Atmospheric Sciences Laboratory to acquire the research data required to determine optimum Army applications. The 55-foot radome houses a 25-foot diameter steerable antenna operating in the 1680 MHz band. The DCP in the foreground is designed to relay meteorological satellite observations from any point on the Earth's disk through an SMS satellite to the DRGS

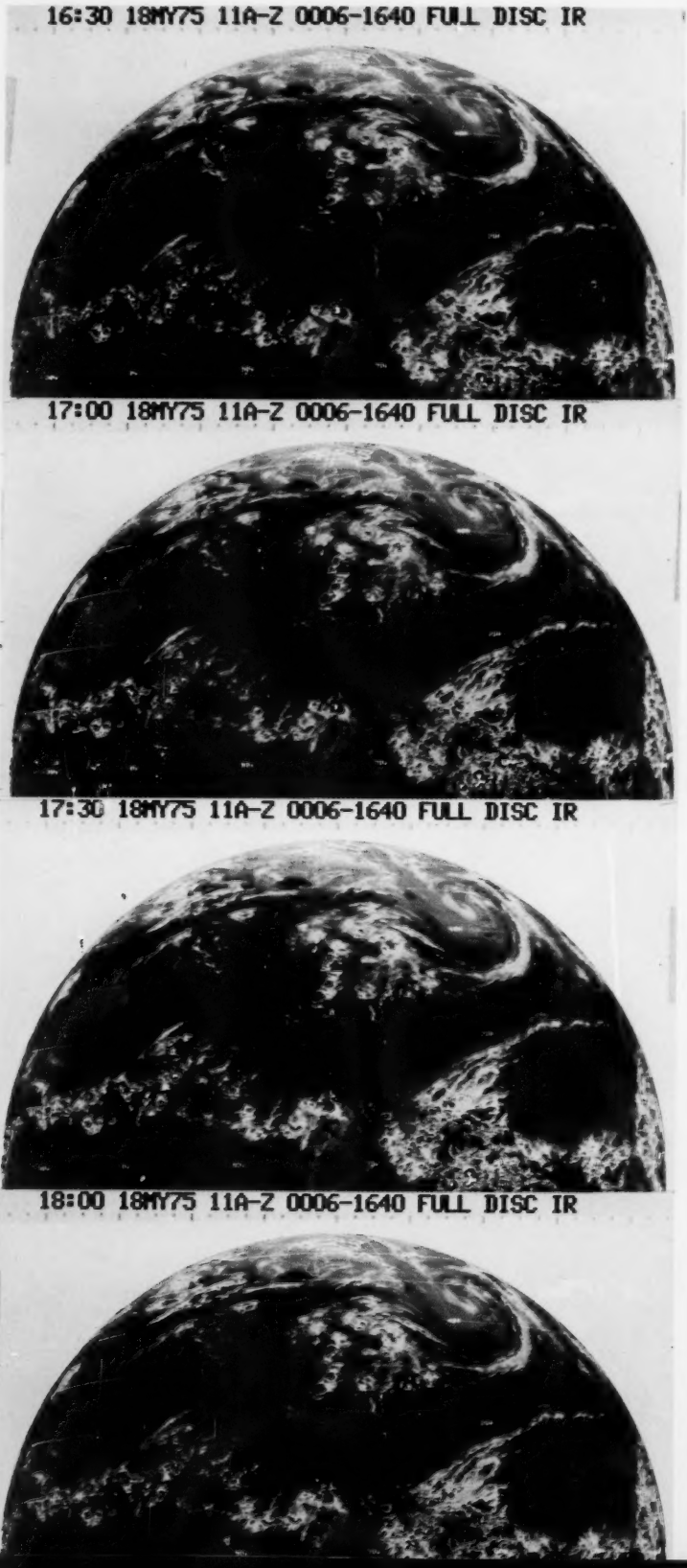
METEOROLOGICAL satellites offer a new and highly efficient means for acquiring detailed aviation weather information for Army pilots over any battlefield.

The U.S. Army is moving to exploit this new spaceage technology in support of battlefield requirements for environmental information. A new initiative was begun in July 1972 by the Atmospheric Sciences Laboratory at White Sands Missile Range. The intent was to apply the current technological capabilities in this new spaceage technology to cost effective solutions of environmental problems which the Army faces on the battlefield.

Two decades of investigation by the National Environmental Satellite Service have demonstrated that meteorological satellites can provide global synoptic observations in a most efficient mode. Today meteorological satellites are assuming a major role in the observational effort required to support the global atmospheric observation and forecast system. Initial studies indicate that dedicated synchronous meteorological satellites in synchronous orbits (stationary to the ground observer) can be focused on mesoscale combat zones and provide cloud cover and visibility data at 1-minute intervals.

A first input of meteorological satellite acquired data into Army battlefield operations currently is being evaluated as a result of a research and development effort titled "SATFAL." The SATFAL deployment involves the use of

Refer to Glossary on page 29



Visual picture of the Earth's disk taken every half-hour

DMSP meteorological satellite VTPR data to replace balloonsondings in the 15 to 30 km altitude region. Radioactivity dosage rates will be calculated from a combination of balloonsondings from the surface to 15 km and satellite data from 15 to 30 km with a resulting significant reduction in meteorological personnel, equipment and activity required to get the basic environmental data on the battlefield. The calculations will be carried out in a minicomputer at a local SATCOM ground station and will be totally user operated.

Army aviation now has the opportunity to use meteorological satellite technology to find solutions to its own unique weather problems. ASL scientists are analyzing the totally new data which is being produced by three synchronous meteorological satellites, the first of which was launched on 17 May 1974 from Cape Kennedy. These satellites give frequent cloud cover observations of particular locales for any region in the Western hemisphere.

The objective of this research effort is to provide Army Aviators with an up-to-minute knowledge of the cloud cover, visibility and severe storm situations over the future battlefield. Presentation will be in an animated video mode after reception of the data through a simplified version of the DCP already developed for the SMS satellites.

SMS spacecraft each weigh about 600 pounds and are spin stabilized at roughly 100 revolutions per minute about a spin axis set parallel to that of the Earth's rotational axis. From an altitude of 22,300 miles over the Equator a 16-inch telescope scans 4-mile wide strips of the Earth from west to east, starting at the North Pole and working down to the

South Pole in 1,821 rotations. This procedure requires approximately 20 minutes for a complete scan of the Earth's disk.

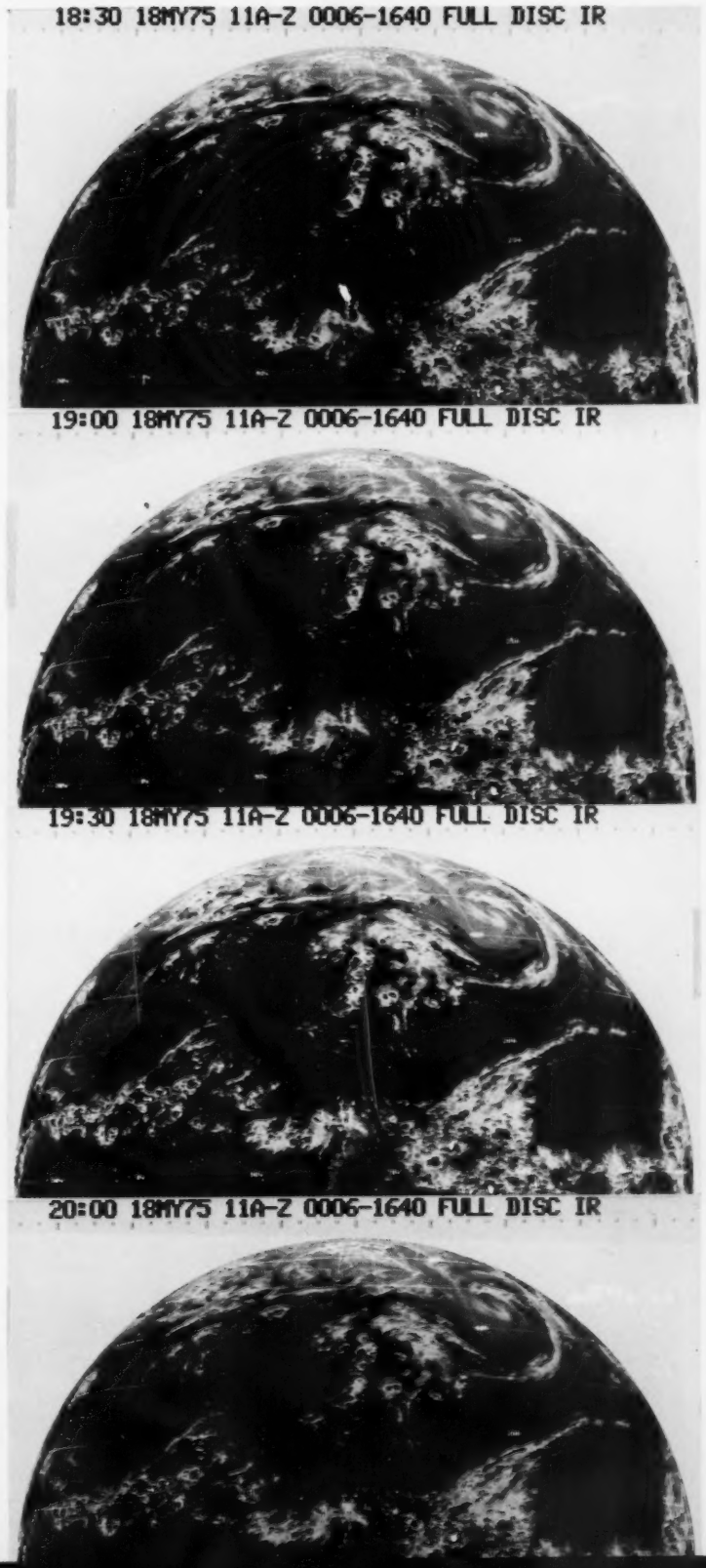
The 4-mile wide strips are required to produce sufficient IR radiation on the satellite IR sensors for effective measurement of the Earth's surface and cloud top temperatures. Visible sensors, on the other hand, are far more sensitive, so that eight of these visible sensors are stacked in the field of view of the telescope and thus produce data for one-half mile strips as the satellite scans. The visual picture of the Earth's disk then, is composed of roughly 15,000 lines of data.

At the launch of SMS-1 the ASL at WSMR had the only ground station capable of receiving and recording on film all of the SMS data. This station consists of a 25-foot diameter steerable antenna which can receive the data from an SMS satellite and make visible and/or infrared tapes and images. The visible image with .5-mile maximum resolution is produced on a 22 x 22-inch piece of film which is rotated on a drum in the ASL facility at precisely 10 times the rotation rate of the satellite. During each rotation while the satellite is faced away from the Earth the eight acquired sets of visible data are burned onto the film in their proper sequence through use of a small computer, a laser and a mobile optical system.

The infrared data produced by the SMS satellites are of primary interest to ASL scientists in their studies of Army battlefield applications because they determine the presence of clouds and measure the altitude of the cloud tops.

Severe storm systems invariably extend to high altitudes where the atmosphere is very cold. Synchronous satellite systems facilitate observation of cloud top

Continued on page 29



Microwave Landing System

John G. Leyden
Chief, Public and Employee Communication Division
Office of Public Affairs
Federal Aviation Administration

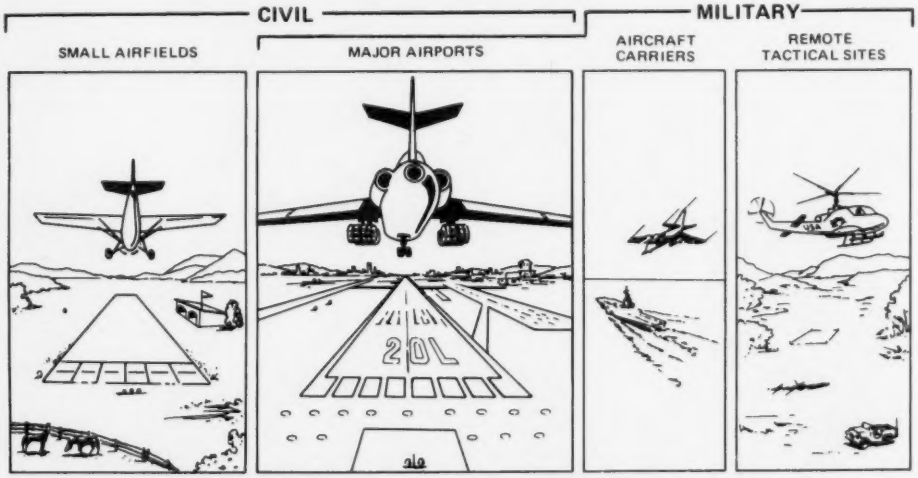
FOR MORE THAN 25 years ground controlled approach (GCA) has been the military's mainstay for precision landing approaches just as the instrument landing system (ILS) has been the standard equipment at civil airports. But now a better system is coming: the microwave landing system (MLS). The MLS is a new, common use civil/military electronic landing and approach guidance system designed to solve many technical and operational problems experienced by existing ILS and GCA installations. It can accommodate the full range of aircraft types and operate in all weather and environmental conditions (figure 1, two sketches).

The day will come when MLS is installed at every major U.S. civil and military airport. When that day comes—before the year 2000 according to present plans—all types of military aircraft will be able to land at military airfields or at MLS-equipped civil airports because all will be using the same kind of equipment. Everybody will be literally on the same wave length, using the same type of electronic landing signals.

U.S. efforts to create MLS began in a big way in 1971 with publica-

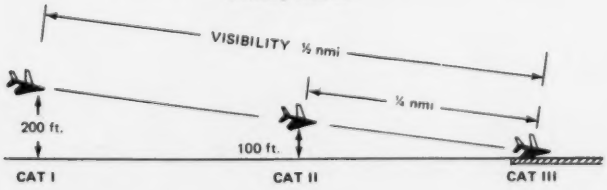
Figure 1

MLS: Service for All Users



Several MLS configurations, tailored to various airports and aircraft

The proposed configurations would differ in capability and therefore in cost. They would range from a low-cost ICAO Category I version for general aviation to a high-performance Category III version, as well as versions for special military needs



The military's Tactical Microwave Landing System made its first major step forward on 2 July 1976, with the award of the Design Definition Phase contract to Bendix and Texas Instruments. These manufacturers will submit their recommended MILSPEC systems to meet the tactical operational requirements of the services. The MILSPEC proposals will be evaluated and a contract awarded that will move us into engineering development phase to produce the first hardware. The Army and the Marine Corps have been given the first priority in hardware development, because of similar operational requirements. Future issues of the *DIGEST* will keep you informed with the progress of the tactical MLS as the program progresses

tion of the National MLS Development Plan, formulated jointly by the Departments of Transportation (DOT) and Defense (DOD) and the National Aeronautics and Space Administration (NASA). An interagency working group was established to implement the plan under the leadership of DOT's Federal Aviation Administration (FAA).

In 1972 the International Civil Aviation Organization (ICAO) began coordinating efforts for development of an international standard MLS, a project involving not only the U.S. but also Britain, France, Germany and Australia. This month an ICAO panel will recommend to the full ICAO membership one of the MLS designs developed by these nations as a new international standard landing aid. Final ICAO selection is scheduled for the first half of 1977. The first MLS systems are expected to go into operation in 1978.

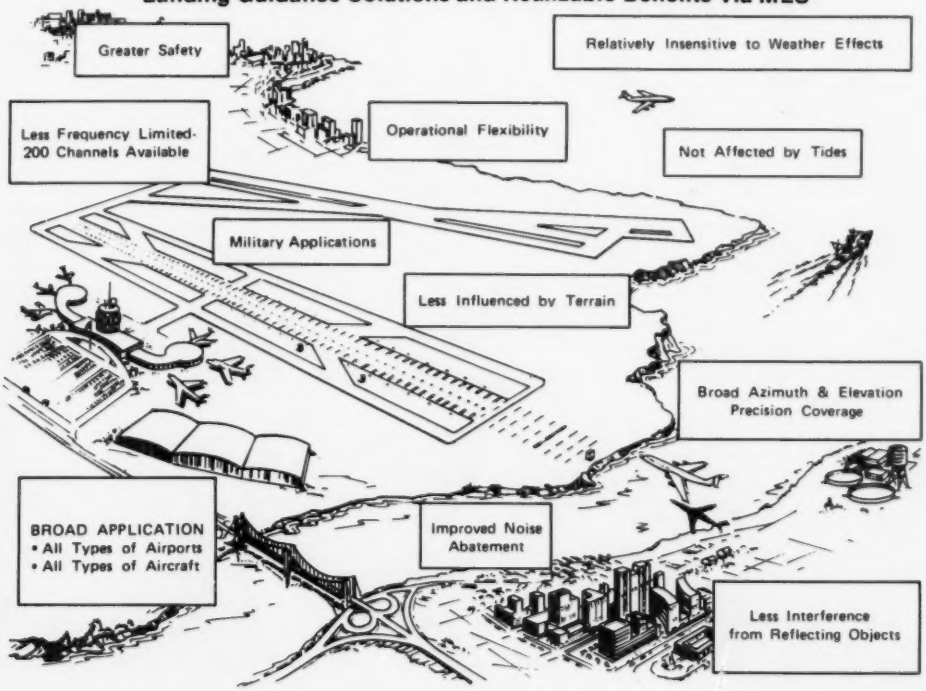
MLS should solve the major problems which limit the usefulness of GCA and ILS. These include poor performance in adverse weather, signal interference from nearby buildings and local terrain, limitation to a single approach path and radio frequency congestion (figure 2).

Ground controlled approach systems, because they require a clear radar picture, can be ineffective at just the time they are needed most—in adverse weather. The controller needs to see the aircraft target on his scope, but his task is made more difficult by trying to guide a target through areas of

Continued on page 20

Figure 2

Landing Guidance Solutions and Realizable Benefits Via MLS



How High the Moon— How Bright the Night?

Garvin L. Holman, Ph.D
U. S. Army Research Institute Field Unit
Fort Rucker, AL

The author offers a practical method for Army Aviators and commanders to predict brightness on *clear nights* for tactical operations. Additional factors affecting the degree of illumination are not discussed here; the intent is solely to provide a relatively simple means to forecast brightness

Figure 1 Fraction of Moon illuminated, 1976

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.01	0.01	0.00	0.01	0.02	0.09	0.13	0.29	0.48	0.56	0.71	0.73
2	0.00	0.03	0.01	0.05	0.06	0.15	0.21	0.39	0.59	0.66	0.79	0.81
3	0.02	0.07	0.04	0.09	0.12	0.24	0.31	0.51	0.70	0.76	0.86	0.88
4	0.06	0.13	0.08	0.16	0.19	0.33	0.42	0.62	0.79	0.84	0.92	0.93
5	0.12	0.20	0.14	0.23	0.27	0.44	0.53	0.73	0.87	0.90	0.97	0.97
6	0.19	0.28	0.21	0.32	0.37	0.56	0.64	0.82	0.93	0.95	0.99	0.99
7	0.27	0.37	0.29	0.42	0.48	0.67	0.75	0.90	0.97	0.99	1.00	1.00
8	0.36	0.46	0.38	0.52	0.59	0.77	0.84	0.95	1.00	1.00	0.99	0.98
9	0.45	0.56	0.48	0.63	0.70	0.86	0.92	0.99	1.00	0.99	0.96	0.95
10	0.54	0.65	0.58	0.73	0.80	0.93	0.97	1.00	0.98	0.97	0.92	0.90
11	0.64	0.75	0.68	0.83	0.88	0.98	0.99	0.99	0.94	0.93	0.86	0.83
12	0.73	0.83	0.78	0.91	0.95	1.00	1.00	0.96	0.89	0.88	0.78	0.75
13	0.81	0.90	0.86	0.97	0.99	0.99	0.97	0.91	0.83	0.81	0.70	0.65
14	0.88	0.96	0.93	1.00	1.00	0.95	0.93	0.85	0.75	0.73	0.60	0.55
15	0.94	0.99	0.98	1.00	0.98	0.90	0.87	0.77	0.66	0.64	0.49	0.44
16	0.98	1.00	1.00	0.97	0.93	0.83	0.79	0.69	0.57	0.54	0.39	0.33
17	1.00	0.97	0.99	0.91	0.87	0.74	0.71	0.60	0.47	0.44	0.28	0.22
18	0.99	0.92	0.95	0.83	0.78	0.65	0.62	0.50	0.37	0.33	0.18	0.13
19	0.96	0.85	0.88	0.74	0.69	0.55	0.53	0.41	0.28	0.23	0.10	0.06
20	0.90	0.75	0.79	0.64	0.59	0.46	0.43	0.31	0.19	0.15	0.04	0.02
21	0.82	0.65	0.69	0.53	0.49	0.36	0.34	0.22	0.11	0.07	0.01	0.00
22	0.72	0.54	0.59	0.43	0.39	0.28	0.25	0.14	0.05	0.02	0.00	0.01
23	0.61	0.43	0.48	0.33	0.30	0.20	0.17	0.08	0.01	0.00	0.03	0.05
24	0.50	0.32	0.37	0.24	0.22	0.13	0.10	0.03	0.00	0.01	0.08	0.11
25	0.38	0.23	0.28	0.17	0.15	0.07	0.05	0.00	0.02	0.05	0.16	0.19
26	0.28	0.15	0.19	0.10	0.09	0.03	0.02	0.01	0.07	0.11	0.25	0.28
27	0.19	0.09	0.12	0.05	0.04	0.01	0.00	0.03	0.14	0.20	0.34	0.37
28	0.11	0.04	0.07	0.02	0.01	0.00	0.01	0.09	0.23	0.30	0.45	0.47
29	0.06	0.01	0.03	0.00	0.00	0.02	0.05	0.17	0.34	0.40	0.55	0.56
30	0.02		0.01	0.00	0.01	0.06	0.11	0.26	0.45	0.51	0.64	0.66
31	0.00		0.00		0.04		0.19	0.37		0.61		0.74

THERE ARE several sources of light in the night environment that are important to the night flying Aviator. TC 1-28, "Rotary Wing Night Flight," describes these sources of light in chapter 3. The brightest source of natural illumination is the Moon.

Continued on page 8

Figure 2

Preparation of globe and paper strip

(DAY 304) GREENWICH A. M. 1976 OCTOBER 30 (SATURDAY) 607

GMT	☉ SUN GHA	Dec.	ARIES GHA ♈	VENUS −3.4 GHA	Dec.	JUPITER −2.4 GHA	Dec.	SATURN 0.6 GHA	Dec.	☾ MOON GHA	Dec.	Lat.	Moon-rise	Diff.
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	N		
00 00	184 04.3	S13 45.1	38 26.2	148 54	S23 31	341 46	N18 44	259 39	N16 40	89 45	S13 14	°	h m	m
10	186 34.3	45.2	40 56.6	151 24		344 16		262 09		92 10	12	72	15 02	−05
20	189 04.4	45.4	43 27.0	153 54		346 47		264 40		94 35	11	70	14 43	−01
30	191 34.4	45.5	45 57.4	156 24		349 17		267 10		97 00	10	68	14 29	+03
40	194 04.4	45.6	48 27.8	158 54		351 48		269 40		99 25	08	66	14 17	05
50	196 34.4	45.8	50 58.2	161 24		354 18		272 11		101 50	07	64	14 07	07
01 00	199 04.4	S13 45.9	53 28.6	163 53	S23 31	356 48	N18 44	274 41	N16 40	104 15	S13 06	62	13 58	09
10	201 34.4	46.0	55 59.0	166 23		359 19		277 12		106 40	04	60	13 50	10
20	204 04.4	46.2	58 29.5	168 53		1 49		279 42		109 05	03	58	13 44	11
30	206 34.4	46.3	60 59.9	171 23		4 20		282 12		111 30	02	56	13 38	13
40	209 04.4	46.4	63 30.3	173 53		6 50		284 43		113 55	13 00	54	13 33	13
50	211 34.4	46.6	66 00.7	176 23		9 21		287 13		116 20	12 59	52	13 28	14
02 00	214 04.4	S13 46.7	68 31.1	178 53	S23 32	11 51	N18 44	289 44	N16 40	118 45	S12 58	50	13 24	15
10	216 34.4	46.9	71 01.5	181 22		14 22		292 14		121 10	56	45	13 14	17
20	219 04.4	47.0	73 31.9	183 52		16 52		294 44		123 35	55	40	13 07	18
30	221 34.4	47.1	76 02.3	186 22		19 23		297 15		126 00	53	35	13 00	19
40	224 04.4	47.3	78 32.7	188 52		21 53		299 45		128 25	52	30	12 54	20
50	226 34.4	47.4	81 03.1	191 22		24 24		302 15		130 50	51	20	12 44	22
03 00	229 04.4	S13 47.5	83 33.6	193 52	S23 32	26 54	N18 44	304 46	N16 40	133 15	S12 49	10	12 35	23
10	231 34.4	47.7	86 04.0	196 22		29 24		307 16		135 40	48	0	12 26	24
20	234 04.5	47.8	88 34.4	198 52		31 55		309 47		138 05	47	10	12 17	26
30	236 34.5	47.9	91 04.8	201 21		34 25		312 17		140 30	45	20	12 08	27
40	239 04.5	48.1	93 35.2	203 51		36 56		314 47		142 56	44	30	11 58	29
50	241 34.5	48.2	96 05.6	206 21		39 26		317 18		145 21	43			
04 00	244 04.5	S13 48.4	98											
10	246 34.5	48.5	101											
20	249 04.5	48.6	103											
30	251 34.5	48.8	106											
40	254 04.5	48.9	108											
50	256 34.5	49.0	111											
05 00	259 04.5	S13 49.2	113											
10	261 34.5	49.3	116											
20	264 04.5	49.4	118											
30	266 34.5	49.6	121											
40	269 04.5	49.7	123											
50	271 34.5	49.9	126											
06 00	274 04.5	S13 50.0	128											
10	276 34.5	50.1	131											
20	279 04.6	50.3	133											
30	281 34.6	50.4	136											
40	284 04.6	50.5	138											
50	286 34.6	50.7	141											
07 00	289 04.6	S13 50.8	143											
10	291 34.6	50.9	146											
20	294 04.6	51.1	148											
30	296 34.6	51.2	151											
40	299 04.6	51.4	153											
50	301 34.6	51.5	156											
08 00	304 04.6	S13 51.6	158											
10	306 34.6	51.8	161											
20	309 04.6	51.9	163											
30	311 34.6	52.0	166											
40	314 04.6	52.2	168											
50	316 34.6	52.3	171											
09 00	319 04.6	S13 52.4	173											
10	321 34.6	52.6	176											
20	324 04.6	52.7	178											

Figure 3 ↑

A daily page from the Air Almanac

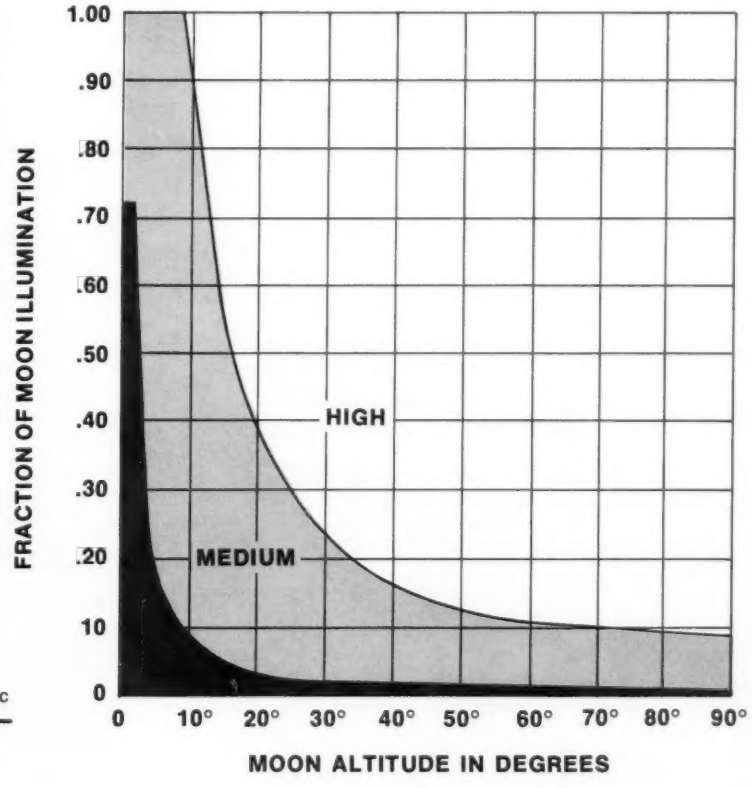


Figure 4 →

Brightness chart

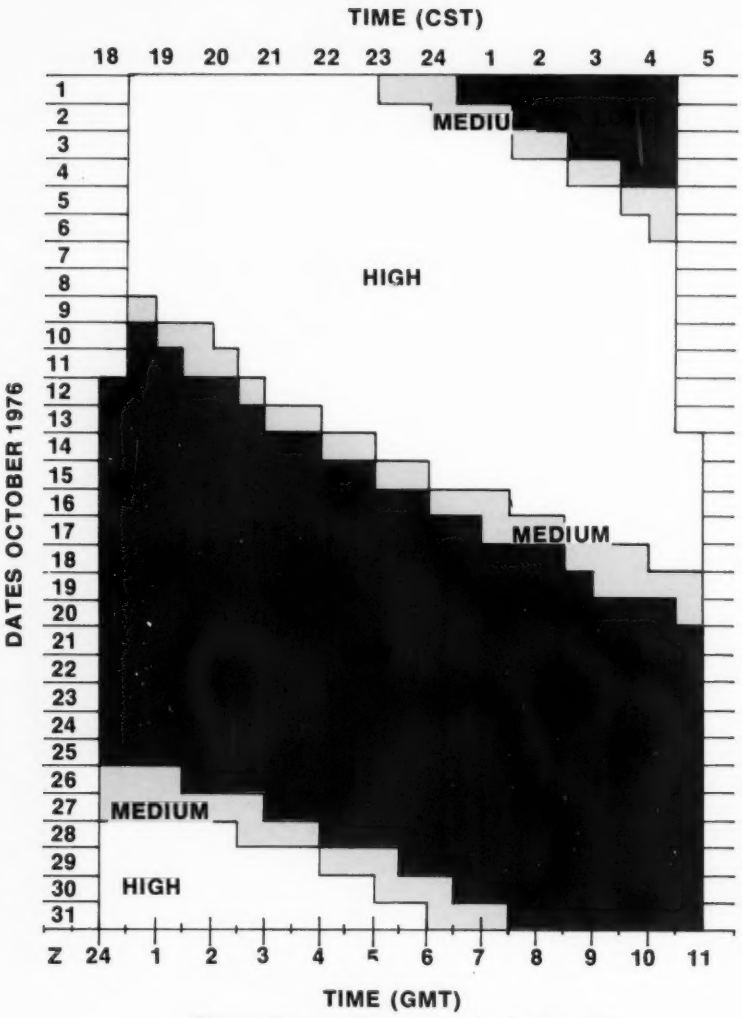


Figure 5 Brightness Calendar for October 1976

Continued from page 6

TC 1-28 suggests that a unit make a light level calendar for each month so that Aviators and commanders can know in advance how bright any clear night will be. This article helps make accurate predictions of clear night brightnesses, using simple procedures and easily obtained manuals and equipment.

Aviators have been using a knowledge of the phases of the Moon to predict how bright the night will be ever since night flying began. A full Moon riding high in the sky provides a bright night. Navigation, even at low tactical altitudes, can be carried out with only a little more difficulty than during the day if the navigator is well trained and proficient in night operations. The opposite extreme, no Moon up at all, results in a dark night and great difficulties in navigation, obstacle avoidance and flying the aircraft. These two predictions are easy to make and require little special knowledge. Local newspapers give Moon phase, rise and set times. But, how about more difficult cases involving partial Moons at different altitudes above the horizon?

The amount of moonlight falling on an area of operations on a clear night depends upon two major factors:

- The fraction of the Moon that is illuminated.
- The altitude of the Moon above the horizon.

The larger the fraction of Moon illuminated, the more light available. Likewise, the higher the Moon is in the sky, the more light available. As an Aviator your operational questions are:

- How do I find out the fraction of the Moon illuminated and Moon altitude for any time in the near future?
- How can I put these two pieces of information together to predict how bright the night will be?

Read on.

The fraction of the Moon illuminated is the easiest to get. Air Force weather detachments will have a chart giving this information for every day in the year. Just ask them for the chart. The chart for 1976 is shown as figure 1. You can easily see that .40 percent of the Moon will be illuminated on 29 October 1976, the day to be used as an example.

The second piece of information, Moon altitude, is a bit more difficult to get. Moon altitude cannot be simply charted on a daily basis like fraction illuminated because the altitude depends on your location as well as the exact time of night in question. If you want to know about current conditions, here and now, go outside and look. To help you estimate the angle of the Moon above the horizon use your middle and index fingers. The spread between the fingertips when fully expanded form approximately a 10-degree arc that can be used to measure the height of the Moon.

Predicting the available moonlight tomorrow night or one night next month requires some special equipment. The first thing required is a copy of the Air Almanac published by the United States Naval Observatory. If your unit does not have one, the local Air Force weather detachment has one which you may be able to use. For convenience you will be better off ordering your own from Superintendent, U.S. Naval Observatory, Washington, DC 20390.

The next special piece of equipment required is a globe of the world *or* a calculator with trig functions. Let's see how to use the globe method and then look into the calculator method.

To prepare a globe for determining Moon altitude, cut a strip of paper about one-half inch wide and long enough to extend a little more than 90 degrees around the globe at the Equator. Hold the strip around the globe at the Equator with one end at 0 degree (just south of Ghana) and the other end to the west beyond 90 degrees (close to the Galopagos Islands). Mark off the edge of the paper strip in degrees at 5-degree intervals from 0 to 90 degrees. This gives you a "ruler" for measuring distances on the globe in degrees. With a chart pin or thumbtack, pin the strip of paper to the globe over your exact position through the 90-degree mark on the strip (figure 2). You are now ready to measure the angle of the Moon above the horizon from your location.

The next step requires finding the location of the spot on Earth that the Moon is directly above on the day and at the time of interest. Refer to the Air Almanac for this information. It is found on the daily pages in the column labelled MOON (figure 3). Turn to the date of interest (29 October 1976) and time of interest (2100 local, Ft. Rucker). The Air Almanac is set up for Greenwich Mean Time (shown in the left-hand column of each page labelled GMT) so the above date and time will be found in the Air Almanac at 0300 hours on 30 October. The column labelled MOON gives the longitude and latitude of the spot on the Earth the Moon is directly over. The GHA figure is the longitude and for 0300 on 30 October, it is 133 degrees 15 minutes. The techniques we are using here do not require accuracies of less than a single degree, so consider only the 133 degrees. This means that the Moon is directly overhead of a spot on the Earth 133 degrees west of the 0-degree longitude.

The second figure, labelled Dec, reads S 12 degrees 49 minutes and means that the Moon is about 12 degrees south of the Equator. Locate 133 degrees longitude and 12 degrees south on your globe. This is the spot the Moon is directly above. Measure the distance from your location in degrees (Ft. Rucker in our example) with the paper strip to find how high the Moon appears. I measure 27 degrees. Remember, 0 degree is the free end of the strip and 90 degrees is pinned to your location on the globe. At this time the Moon will be 27 degrees above the horizon from Ft. Rucker with .40 of it illuminated.

The second question, concerning how to put these two pieces of information together to predict brightness, easily is answered. Moon altitude and fraction illuminated are combined in the graph in figure 4 to tell you brightness levels. Find the intersection of .40 and 27 degrees and note the light level indicated. In our example it is HIGH. This was not an obvious conclusion since the Moon is less than half illuminated and not very high above the horizon. Obviously, the night will not be as bright as it would if the Moon were full and very high, but it will still be bright enough to be considered HIGH.

Here are a few more thoughts about measuring Moon altitude. If the Moon's overhead location is beyond the reach of your 90-degree long paper strip, the Moon is not visible at your location. It either has set already or has yet to rise. If the Moon's overhead location is at 0 degree or just 1 degree or 2 degrees, it will appear right on the horizon. The closer the Moon's overhead position is to your location, the higher above the horizon it is. The extreme would occur if the Moon was directly overhead of your location. It would then be 90 degrees above the horizon which is what the paper strip indicates since it is pinned to the globe at your location at its 90-degree point.

What is the operational significance of the HIGH, MEDIUM, and LOW light levels shown in figure 4? Roughly speaking a HIGH brightness level means that the Moon is bright enough so that on a clear night most normal operations, including terrain flight navigation, can be performed without undue difficulty. This does not mean that it is "bright as day" and no special procedures need be taken. Even on the brightest of nights there is not enough light available from the Moon to distinguish colors of objects on the ground. Visual detection and identification of objects, whether they are targets, obstacles or checkpoints, will be more difficult than in the day. However, a well trained and dark-adapted pilot/navigator team can fly safely at night. Navigation, even over unfamiliar terrain, can be accomplished if the team has preplanned the flight in sufficient detail. Normal maneuvers and obstacle avoidance can be performed even at tactical low level altitudes if the crew is dark-adapted and does not fly at high speeds.

A LOW brightness level means that on a clear night there is so little

Continued on page 19

OUTLOOK

The author wrote Parts X, XI and XII of "The Army Aviation Story" published in the June, July and August *DIGEST*s. Major Price now contributes his conclusions regarding Army Aviation

MAJ David H. Price

ARMED WITH THE vast combat experience of today's Aviators and the lessons and portents of the 1973 Middle East conflict, aviation planners have begun to reorient the Army's flying force to the mid-intensity (high threat) environment. Key Army leaders, both rated and nonrated, have taken time to reflect upon the enemy threat and our capability to respond. The new FM 90-1, "Employment of Army Aviation Units in a High Threat Environment," and the *DIGEST's* "Tactics Sampler" are outstanding contemporary contributions to the Army community as a whole and Aviators in particular.

The focus on the high threat environment is well-placed. Although there are several types of wars possible in the atomic age, the mid-intensity, nonnuclear situation seems to be the most appropriate scenario on which to orient the force. To project our thinking and preparation from the lower intensity Vietnam type combat into today's high threat environment is a definite but gradual, manageable progression for both doctrinal planners and operational Army aviation units. In short, it is possible to prepare for such a war, and it is a good place to start.

Key issues: In dealing with this new orientation I will not try to summarize the recent penetrating and articulate comments of many senior commanders. I will address four key issues which, in my opinion, seem to be vital to the success of the Army's endeavors in preparing for the new combat. From my perspective the crucial issues seem to be:

- institutional relationships
- training philosophy
- intensive flying
- simplicity

Institutional relationships: Army aviation exists as an integral resource of the ground commander. Our institutional responsibility as aviation Soldiers must be one of total support. The Army owes aviation something in return, however—the continued interest of its ground arms in keeping aviation part of the combined arms family. Integration of air and ground resources must be deliberate, innovative and challenging. In many respects it is up to the ground arms to keep it so, for it is after all ground objectives which Army aviation helps achieve.

On a broader scale the Army must strive to work out its problems with the other services, particularly where the air clashes. In this crucial area roles and missions become intertwined and wasteful overlaps as well as dangerous voids develop. Many of the differences between Army and Air Force were worked out in the air over the Republic of Vietnam. Some of the solutions found in battle have been institutionalized. Others have not.

Lieutenant General Robert R. Williams, in a recent issue of *ARMY AVIATION*, pointed out the philosophical clash which exists between centralized organizations like the Air Force and decentralized organizations like the Army. General Williams' discussion of voids is most relevant. A void allowed the birth and development of organic Army aviation in 1942. The attack helicopter owes its existence to a void in the 1960s, and a significant void exists today in the short-range tactical air transport business.

Overlap in roles and missions is wasteful but voids between the services' capabilities to provide vital functions force the participants to play catch-up football when the crisis comes. Clearly, the national interest must be foremost in allocating resources to certain functions. The responsibility for discovering and defining problem areas in air matters rests primarily with Army Aviators.

Training philosophy: The shift to the mid-intensity, high threat environment demands far more complex and intense crew training. The days of unlimited taxi service are gone. Nap-of-the-earth and night formation flying are serious business. In combat both can be deadly for the undertrained. The aviation commander no longer can depend upon "services rendered" to the ground arms as all-inclusive success criteria. If those under his command are to be fully integrated into the combined arms team, he must see to their training. The aviation commander must be given the time, money, resources and latitude with which to train his unit. The senior commander with organic aviation units assigned must realize that he is responsible for their readiness, really responsible, and must direct his command emphasis thereto.

Safety guidelines must be studied and restudied in light of concurrent developments in states of training and equipment. It is not safe to fly

close to the ground and under wires. Accidents are going to happen. We cannot afford to adopt a "punitive" accident prevention policy. Army aviation, if it is going to fight in *and* survive the first great battle of the next war, is going to have to be ready. The unit that lives to fight another day will be the one that is trained in a deliberate, disciplined, but aggressive manner.

Intense Flying: The term "mid-intensity" is not descriptive of the flying in and around the FEBA (forward edge of the battle area) in the battle situation so described. "High threat" is more accurate in depicting the most hostile environment in which Army Aviators will have ever been employed. Flying will be a highly intense experience. A brief 30-minute mission at the FEBA will in all likelihood be many times more volatile, demanding and fatiguing than the 10- and 12-hour days in the cockpit in Vietnam.

The employment of attack helicopters in mass for example will require deliberate, thorough planning on the part of every teammember. Aviator concentration on the team effort will be a more important factor than individual bravado, although the latter will still have a place. Crew fatigue will take a serious toll on the number of sorties available to the ground commander.

The danger level will reach intense proportions. Violence in the first battle is liable to be much greater than we anticipate. Our helicopters are going to be shot down in great numbers. Knowledge of the overall ground plan beforehand, and the human capacity to take command and continue the mission despite incalculable adversity, will force new and greater demands on Aviators than ever before. The key to success in intense combat is intense training. Will we be ready?

Simplicity: The European type battlefield will feature sophisticated weapons and gadgetry. Command and control will be overwhelmingly complex. The flying commander's task is to reduce complexity and confusion by issuing simple orders. Individual judgments will be impaired by the noise and disorder of ubiquitous battle. The simpler the order, the more likely it will be carried through to success.

Simplicity also must be applied to aviation technology. Most battlefield aviation tasks will not take place in view of the enemy or in range of his direct fire weapons. The weapon requirements for an armed helicopter providing security in the rear area is vastly different from those for attack helicopters required to engage and defeat tanks. If all our aircraft must be equipped to fight at the front, we may price ourselves out of business. Then too, the more sophisticated the aircraft the more time it takes to gain and maintain proficiency, and that is before even beginning tactical training! The Army helicopter family must contain simple, reliable vehicles for the less dangerous support tasks, and quick, deadly machines at the "cutting edge."

Even though we focus on the mid-intensity war, we should not be naive enough to disregard the everpresent potential for the outbreak of nuclear war. What is the probability that tactical nuclear weapons would be used in the defense of Europe? Can airmobile forces be effective in the nuclear environment? Can they even survive? Are Army helicopters candidates for massive concrete revetments? What would revetments do to the "live in the field" philosophy that advocates of organic aviation have so long defended? These are the types of questions which beg answers, and the answers should come from Army Aviators.

Certainly, we cannot allow ourselves to forget Vietnam. The enemy, fresh on the heels of success in Southeast Asia and Angola, is likely to undertake new adventures. Army aviation was among the first in and last out in Vietnam. We could be so engaged again, if and when the Nation calls.

A glance at our history reveals that, for a Nation that loves peace, America has had many wars. Our longest period without major war came between 1918 and 1941, during which time we shrank from our international responsibilities and allowed tyrants to rise in both hemispheres. The atomic age is fraught with the dangers of nuclear holocaust, but aggression continues unabated. Peace is not at hand. The chances for conflict remain great. We must be ready.

The future of Army aviation in the 1980s and beyond is bright, but not without obstacles. The Nation will spend only so much on defense in the period between wars. We must all do what we can to ensure that we get the most out of our budget dollar. We must be ready for combat on the battlefield we feel to be most imminent, but we must not neglect the other potential conflicts in our preparation. We are indeed entering a new era. The key to that era is dedicated, deliberate preparation and fresh, innovative thinking on the part of aviation Soldiers everywhere.

The Army Aviation Story [Parts I thru IX, June 1962 through February 1963; Parts X, XI and XII see June, July and August 1976] from balloons to tankkillers, is a story of dedicated, professional Soldiers who cared enough to fly "ABOVE THE BEST."

> "The one inescapable conclusion is that the airmobility concept is irreversible. The thousands of officers who have learned to think and fight and live in three dimensions will never allow themselves to be restricted to two dimensions in the future. Airmobility will change and grow, but it is here to stay."
>
> LTG John J. Tolson III

From Mission Order

Points for a Successful Instrument Flight

THE PORTION FROM mission notification through instrument takeoff is by far the most important of any instrument flight. Regretfully it is the most often overlooked and understressed section after an individual leaves flight school. A checklist will assist the pilot in completing a successful flight. The following points compile this checklist and are covered with explanations where necessary.

MISSION—The pilots should be briefed at least 2 hours in advance of the proposed departure time. This will allow time for completion of the points outlined in this checklist.

FLIGHT PLANNING:

FLIP Material and Regulations: A complete understanding of the FLIP publications with the latest changes is a must. Up-to-date publications usually can be found in your local operations section. Ensure that your approach charts, IFR supplement, SIDs, etc., are complete and current. Understand AR 95-1, AR 95-63, FARs and local operating procedures.

Preflight Planning:

Initial weather check:

- Destination weather
- Requirement for, and selection of, an alternate
- General enroute forecast, winds aloft and freezing level
- Nearest available field (if taking off from a field with weather below approach minimums)

Route Planning:

- Availability of SIDs or radar vectors
- Check preferred routes and NOTAMs
- Select route and check MEAs, MOCAs and MRAs
- Select best altitude(s)
- Compute for TAS and groundspeeds
- Prepare DA Form 2283 or other type flight log as desired
- Compute ETE from T/O to radio facility or initial approach fix serving destination airport
- Prepare DD Form 175, flight plan, for each leg as shown in General Planning of the FLIP publications

Destination—study approach charts for:

- Minimums for authorized approaches
- Transitions to final approach fix
- Field elevation
- Missed approach
- Radio frequency, UHF—VHF (approach control; tower; ground; clearance delivery)
- IFR supplement for fuel and other services that might be required at destination

Fuel Computation: Plan the fuel that you need for your flight by using a unit-kept record of the aircraft's rate of consumption and consumption derived from performance charts in the operator's manual. Ensure sufficient fuel to complete planned flight. *Do not cut corners in your fuel planning.*

- No alternate required —destination to missed approach fix plus 45 minutes at normal cruise. (Don't forget starting, taxiing, runup, climb consumption and possible ATC enroute delays.)
- Alternate required—destination to missed approach fix to alternate plus 45 minutes reserve at normal cruise
- If, upon arrival at the destination airport, the required minima

To Instrument Takeoff

CW2 Joel E. Warhurst

Command Pilot
U.S. Army Aviation Center

LIST

Refer to Glossary on next page

does not exist, a pilot may not commence approach. He may request ATC instructions to hold if the forecast is favorable and all alternate airfield requirements can be met

COPILOT BRIEFING—Brief your copilot by utilizing a briefing card. If your unit does not have one, the one shown in the box on page 14 may be used with changes to suit your particular mission.

175-1 WEATHER BRIEFING AND FILING THE FLIGHT PLAN—After completing the above procedures we can receive our final weather briefing and check NOTAMs prior to completion of 175-1. Know weather conditions at the departing airport, enroute and at the destination airport. An understanding of the aircraft limitations in regard to turbulence and icing should be reviewed at this time if there is any doubt in your mind. The flight plan may now be submitted to the appropriate clearance authority for approval (if necessary) and transmittal to FAA or appropriate flight service facility.

PREFLIGHT AND RUNUP—A complete preflight utilizing the appropriate aircraft checklist is next on the list of musts. *There is no replacement* for the oral callout and confirmation method during the preflight and engine runup.

RADIO CHECK—It is a fact that the radio check is part of the engine runup section of the checklist, but a reiteration of this vital check is important. A standardized system will help to ensure that each radio is properly working and set to the first usable frequency.

- Proximity warning device is checked in accordance with TM 55-1520-210-10 (if aircraft is equipped)
- NAV monitor switch as desired
- Transponder checked for mode "A" with selector switch in the ON/NORMAL position. Deflect TEST switch and check for return light. Return to STANDBY position and ensure that the proper mode is set with the anticipated code when known
- ILS check: Check a localizer frequency and ensure that you can receive a reliable signal and that the course indicator is showing in the proper sector
- VOR check: Check a VOR frequency and ensure that you can receive a reliable signal. Complete the check with one of the prescribed VOR receiver checks in your local area. Set course and frequency
- ADF check: Put FUNCTION switch in COMP mode. Check BFO OFF. Check High Band, Middle Band, Low Band for all bands with No. 1 needle pointing in general station direction. Check at least one band by displacing needle 30 degrees left and right with LOOP lever. Set desired frequency
- VHF Emergency Transmitter or VHF Transmitter Receiver should be checked by calling a usable frequency
- The UHF radio can be omitted at this time because it will be checked on your call to clearance delivery, ground or others

PRIOR TO INSTRUMENT TAKEOFF—Refer to crewmembers' checklist.

COMPUTE FOR THE INSTRUMENT TAKEOFF—Check to ensure that you are within the limitations of the aircraft

INSTRUMENT FLIGHT
COPILOT BRIEFING

INTRODUCTION
- Determine copilot qualifications
- Uniform and equipment
- Type and ID of aircraft and equipment

COPILOT'S DUTIES
- Fly headings/track, airspeed and altitude as assigned
- Tune and ID commo and nav radios as requested
- Perform takeoff, leveloff and landing checks on request
- Record power settings, fuel and times as requested
- Copy all clearances, headings, altitudes, frequencies and other information received from controllers when pilot is at controls
- Monitor aircraft instruments and caution lights
- Compute fuel and compare with pilot's
- On breakout and field in sight, land A/C on appropriate runway
- Be prepared to execute a missed approach

OPERATIONAL PROCEDURES
- Transfer of aircraft control—routine, emergency
- Alert for reported aircraft and VFR conditions
- Mission
- Route of flight, approaches and alternate if required
- Weather: Takeoff, enroute, destination and alternate
- Approach briefing—
  - ID of approach
  - MDA or DH
  - Time from fix to field
  - Verify missed approach procedures
- Emergency Procedures: Engine, electrical and hydraulic. Assist with switches and circuit breakers as required

envelope and that you have sufficient power in accordance with the GO - NO GO plaque. A review of this is covered in the aircraft's operator's manual. First flight or just for safety—employ engine HIT.

BEFORE INSTRUMENT TAKEOFF—Refer to crewmembers' checklist (double checks for professionals).
- Check weather void time
- Recheck for attitude indicator set
- Clock set to tower time
- Heading indicator set with index over takeoff heading (cross check magnetic compass)
- Transponder set to proper mode and code
- Departure control frequency set
- Recheck VOR frequency and first usable course set in the OBS
- Recheck ADF frequency for first usable station

COPILOT'S RESPONSIBILITY ON TAKEOFF:
- Record takeoff time
- Record amount of fuel (compare at leveloff)
- Turn transponder to ON position as instructed by ATC
- Set departure control frequency on request
- Turn pitot heat on, if aircraft encounters visible moisture
- Engine anti-ice on if appropriate (Caution: power limited due to increased EGT)

If the preceding steps are incorporated in every instrument flight, along with pilot experience and a thorough understanding of flight regulations and publications, you are well on your way to a successful completion of any mission associated with instrument flight.

GLOSSARY

A/C	aircraft
ADF	automatic direction finder
ATC	air traffic control
BFO	beep frequency oscillation
COMMO	communication
COMP	compass
DA	Department of the Army
DOD	Department of Defense
DH	decision height
EGT	exhaust gas temperature
ETE	estimated time enroute
FAA	Federal Aviation Administration
FAR	FEDERAL Aviation Regulations
FLIP	flight information publications
HIT	health indication test
ID	identification/identify
IFR	instrument flight rules
ILS	instrument landing system
LOOP	refers to Loop antennae
MDA	minimum descent altitude
MEA	minimum enroute altitude
MOCA	minimum obstruction clearance altitude
MRA	minimum reception altitude
NAV	navigation
NOTAM	notice to airmen
OBS	omnibearing selector
SID	standard instrument departure
TAS	true airspeed
T/O	takeoff
UHF	ultra high frequency
VFR	visual flight rules
VHF	very high frequency
VOR	VHF omnidirectional range

ARMY AVIATION HALL OF FAME

Chief Warrant Officer (CW4)
Michael J. Novosel

DURING THE VIETNAM WAR, Chief Warrant Officer (CW3) Michael J. Novosel was a Dustoff pilot—that almost legendary breed of helicopter flier whose record in rescuing wounded men during battle is one of the proudest chapters in the Vietnam War.

He was credited with evacuating more than 2,200 wounded persons and "extracting" some 5,500 wounded Soldiers and Vietnamese in all. His 60 Oak Leaf Clusters to his Air Medal, his three Distinguished Flying Crosses and his Purple Heart denote a remarkable man.

At age 48 he became the oldest member of the Army to win the Medal of Honor, the award being made for his repeated bravery in the face of heavy Viet Cong gunfire while he extracted 20 wounded South Vietnamese soldiers during 2½ desperate hours of flying on 2 October 1969.

A lieutenant colonel in the Air Force Reserve when the Vietnam conflict began to broaden in the early 1960s, Novosel wanted to help in some way. Finding the USAF overstrength in its senior grades, he obtained 4 years military leave from his employer and joined the Army aviation program in June 1964 as a warrant officer.

As a member of the Special Forces in 1965, he evacuated wounded civilians to hospitals when the U. S. intervened in the Dominican Republic civil crisis.

Warrant Officer Novosel has dedicated his life to aviation, to the military services and to his country. This dedication sets him apart as a man, and makes him most worthy of induction into the Aviation Hall of Fame.

Chief Warrant Officer Michael J. Novosel, now CW4, is presently assigned to the U. S. Army Aviation Center where he serves as an instructor in the Warrant Officer Senior Course.

VIEWS FROM READERS

Sir:

The Society of U. S. Army Flight Surgeons last May presented the Aerospace Medicine Specialist of the Year Award to LTC J. J. Treanor. Dr. Treanor is the first recipient of this award. It was given in recognition of outsanding service to Army aviation and aviation medicine.

Dr. Treanor was cited for extraordinary devotion to duty and dynamic leadership in reorganizing the U.S. Army Aeromedical Activity, Department of Professional Education, at the U.S. Army Aviation Center, Ft. Rucker, AL, and his widespread influence upon working flight surgeons in the field.

Dr. Treanor is a former Infantry sergeant and received his commission in the Corps of Engineers during the Korean War. He is a certified specialist in Aerospace Medicine and a Fellow of the American College of Preventive Medicine. Dr. Treanor is a fixed wing Aviator and senior parachutist with a broad background in tactical airborne units and specialized aviation problems.

COL Raphael J. DiNapoli
Commander
U.S. Army Aviation Medical Center

Sir:

Reference your April 1976 issue and the article, "We'll Make a Weather Check," written by Ted Kontos of USAAAVS.

There is no question accidnts of this type can be categorized as "Dumb" but there are a few statements in the article that I take issue with.

Reference is made to AR 95-5 para 5-4e, regarding establishing procedures for obtaining weather. Reading the cited paragraph you see the following: "Weather. Many Army aviation missions are flown where weather observations and forecasting facilities are inadequate or nonexistent. Aviation personnel must be fully indoctrinated with the weather conditions peculiar to their area of operation. Established procedures for marginal conditions must be formulated and followed."

In the current Army Field Division we have a detachment of Air Force weather personnel designed to provide support. When the Division moves to the field the base airfield must be kept open. We now have a very small staff, located at the Division TOC. The primary mission of this small group is to provide the ground commander with weather information, aviation units take what is left. As a result the only way at times is to "make a weather check."

We certainly cannot condone the type of accident that is described in Mr. Kontos' article. On the other hand we must face reality. AR 95-1 says a weather briefing is required while AR 95-5 acknowledges that at times it is impossible to obtain. The pilot concerned is the one caught in the middle. The old "be damned if you do and be damned if you don't" fits quite well. Let's get adequate weather forecasting facilities first and then require our people to use them and we won't have to "make a weather check."

ELMER B. GEIGES
DAC Aviation Safety
Officer, USAREUR

• Both the U.S. Army Agency for Aviation Safety and the U.S. Army Aviation Center are in general agreement on the points made in your letter. Action officers who have responsibility for collating recommended changes to AR 95-5 and AR 95-1 will address your suggestions during the forthcoming revision of both regulations.

Sir:

The theme of an Army Aviation Association of America (Monmouth chapter) symposium recently held at Fort Monmouth, NJ, was "Aviation Electronics Technology and Systems Developments to Meet Present and Future Army Requirements." Papers were presented by individuals from numerous governmental research and development agencies as well as by industrial representatives. While most of the papers presented were quite technical and of more interest to research scientists than to the average Army Aviator, the topics these papers covered, however, are of interest to the Army aviation community.

Following opening remarks by COL Lee M. Hand, who chaired the symposium, "The User's View" was presented by BG Robert A. Holloman HI, deputy commander of the U. S. Army Aviation Center at Fort Rucker. COL W. E. Crouch Jr., office of DCS for Research Development and Acquisition, presented "Aviation Electronics, A Systems View" and CPT J. R. Pederson of the Aviation Center gave a briefing on the "Army Threat."

Following these presentations concurrent sessions were held for the rest of the symposium. At afternoon sessions of the 2-day meeting, remotely piloted vehicles (RPVs)

MG Spurgeon Neel center presents the 1st Aerospace Medicine Specialist of the Year award to LTC J. J. Treanor. COL Raphael J. DiNapoli Jr., Commander, USAAMC, is at right

and air/ground systems were discussed. Of particular note was a paper presented on the position location reporting system (PLRS).

This system, which has completed a joint service test in southern California, presents one possible solution to the Army's problem of knowing where everyone is on the battlefield of the future.

On the second morning the concurrent sessions were on nap-of-the-earth (NOE) flight and airborne avionics. In the NOE session presentations were given on "A Low Cost Wire Obstacle Warning System," which is still in the study stage of development; "Tactical Hover Under NOE Conditions," which addressed the problems of hovering at night or during limited visibility using night vision systems; "Evaluation of Night Vision Requirements for AAH/ASH" (advanced attack helicopter/advanced scout helicopter) discussed the ongoing testing by the Night Vision Laboratory to identify the right combination of night vision equipment (above and beyond the AN/PVS-5 night vision goggles) for our future aircraft. Other papers at this session were "Design for NOE," presented by the Human Engineering Laboratory; "Target Location and Navigation Systems," dealing with the possibility of using a lightweight doppler navigation system (LDNS) to help solve the problems of target location, target handoff and aircraft navigation; and the last presentation was "The Measurement of Pilot Workload in Manual Control Systems."

At the airborne avionics session some of the subjects addressed were "Why Not Fly-By-Wire?"; "A Lightweight Doppler Navigation System for Helicopters"; and "Laser Inertial Navigation System (LINS) Test Results."

The three afternoon concurrent sessions were "Airborne Communications," "Advanced Electronics Components" and "Electronics Test and Evaluation." Of particular interest were two presentations given at the "Airborne Communications" session: "NOE Communications" and "UHF SATCOM (Satellite Command) FM Voice Link for NOE Missions." These two papers significantly illustrated the research and development community's awareness of the communications problem when flying NOE and are working on a solution.

At the banquet guest speaker BG Samuel G. Cockerham, Project Manager for the Advanced Attack Helicopter, presented an outstanding summary overview of the AAH program.

The purpose of the symposium was to inform and update those individuals doing research and development in the field of Army aviation electronics with what other Government agencies and the civilian industrial community are doing to help solve the multitude of complex problems that face Army aviation. It was indeed a success.

CW3 Chuck Tidey
Project Pilot
Experimental Vehicle for Avionics Research (EVAR)
Fort Monmouth, NJ

Sir:

Reference your article on page 4, June 1976 edition of the *AVIATION DIGEST*.

On June 14, 1976, the Army completed 201 years of service to the Nation, not 200.

SP5 Harold G. Flanagan
2d Staff and Faculty Co.
Fort Eustis, VA

• Of course, you are correct. The *DIGEST* recognized the Army's 200 years of service to the Nation in its June 1975 issue.

Sir:

The development of a crashworthy troop seat has resulted in a Department of the Army Outstanding Research Development and Technical Achievement Award for Mr. Joseph L. Haley Jr., a civilian employee at Fort Rucker.

BG Kenneth R. Dirks, [now MG], commander of the U.S. Army Medical Research and Development Command, Washington, DC, made the presentation at the U.S. Army Aeromedical Research Laboratory, where Mr. Haley is assigned.

During the presentation General Dirks praised Mr. Haley as a recognized international authority in the field of aviation crashworthiness in crash injury research and cited him for his extraordinary accomplishments and dynamic leadership in the development of safer aircraft. He also noted that the crashworthy troop seat would reduce fatalities and eliminate injuries and that this was exemplary in the application of engineering and preventive aviation medicine to conserve the fighting strength.

Mr. Haley's troop seat absorbs energy and can face forward, back or to the side. The seat features highly unique and innovative load-limiting devices to weaken crash loads. It uses ceiling cockpit structures, nonrebounding open steel mesh seat pans, and other load-limiting devices never before incorporated in such a comprehensive manner.

Mr. Haley came to Fort Rucker from the Aviation Safety Engineering Research (AVSER) Division of the Flight Safety Foundation in Phoenix, AR, in 1969. He first worked for the U. S. Army Agency for Aviation Safety and primarily was concerned with aircraft crashworthiness. During the latter part of 1972 and in 1973 he began his design of the crashworthy troop seat.

After transfer to his present assignment,

The *AVIATION DIGEST* monthly winner shield was inadvertently ommitted from the winning story in August, "A Good Safety Record Is No Accident" by CW2 Joe S. Adams II. Our sincere apology to the author.

(Below left) General Robert A. Holloman III who presented "The User's View" speaks with Colonel Lee M. Hand, symposium chairperson. At right, Colonel W. E. Crouch Jr. conveys "Aviation Electronics, A Systems View"

BG Dirks presents the Outstanding Research Development and Technical Achievement Award to Mr. Haley

Mr. Haley continued to work on development of the seat. This involved working with aircraft mockups and feasibility studies as well as full-scale crash testing. A few prototypes now are being used on Army aircraft.

Presented by the Department of the Army and Assistant Secretary of the Army for Research and Development, Mr. Haley's award is given for an outstanding or scientific or technical contribution by a Department of the Army civilian scientist working in the Army's research and development community. It consists of an engraved bronze medallion, an engraved bronze achievement scroll and a citation recognizing Mr. Haley's contribution to the invention, development and validation of a crashworthy troop seat. He was commended for "an achievement that will reduce fatalities and prevent injuries among passengers who are involved in helicopter accidents."

COL Stanley C. Knapp
Director, Bioengineering and
Life Support Division
U. S. Army Aeromedical Research
Laboratory
Ft. Rucker, AL

BABY BORN DURING MAST FLIGHT

GUINNESS CAN add another record to the book because of the delivery of a 4-pound baby girl on a Ft. Carson Military Assistance to Traffic and Safety (MAST) helicopter at 8,000 feet, 23 June, while enroute to Fitzsimmons Army Medical Center in Denver, CO.

This was the first time, in the United States, a baby has been delivered in a military helicopter.

Private First Class Glenn Lewis, 124th Signal Battalion, the baby's father, was on guard duty and didn't find out about the arrival until late Wednesday evening when the MAST crew returned from Denver.

"We had competent people aboard with some of the best equipment available, there couldn't have been any problems," MAST pilot, Kenneth B. Hogan convinced himself.

The baby was delivered at 7:48 Wednesday evening by Specialist 5 Tom Haverkorn and Private First Class Debra Kleinfelter. Both are medics in the 571st Medical Battalion at Carson. "The contractions were 2½ minutes apart when we left and before we got out of the city they were at 1½ apart," explained Haverkorn. "The baby was 4 weeks premature and complications were expected."

According to a Fitzsimmons spokesman the mother is in good condition after the natural birth and Heather Ann is doing well.

(L) Happy parents PFC and Mrs. Glenn Lewis look in on their baby in the incubator before the baby's release from Fitzsimmons

(R) MAST crew and helicopter on which Heather Ann was born. (LtoR) Hogan (P); Haverkorn and Kleinfelter (medics); Prince (CC); Schiltz (CP)

Continued from page 9

How High The Moon . . .

moonlight available that normal operations can be conducted only with considerable difficulty and great caution, if at all. A typical LOW night has no Moon at all and in a tactical area no artificial lighting. On a clear night the major source of illumination is starlight. On a starlight night tactical operations become much more difficult. Navigators find it much harder to see checkpoints, to distinguish forest from clearing, to discriminate draws, hills, saddles and other natural features, to detect features on the ground such as roads and streams. Pilots find it much harder to detect and avoid obstacles, to perform maneuvers confidently close to the ground, and to maintain a reliable horizon reference.

A MEDIUM brightness level marks a transition from HIGH to LOW. It is a brightness level in which operations are more difficult than in HIGH but not as difficult as in LOW. You should note, however, that a MEDIUM level very close to HIGH will not differ a great deal from the lower brightnesses of HIGH. Likewise, in a MEDIUM brightness close to LOW, operations will become difficult as in LOW. An inspection of a monthly brightness calendar (figure 5) shows that a MEDIUM brightness level is present for only ½ to 1½ hours a night. This is a relatively short period when compared with the much longer periods in which the night is HIGH or LOW.

Notice that the discussion above assumes a clear night and little artificial lighting. Weather can make large differences in brightness. An overcast can easily change the classification of a HIGH night into a MEDIUM or a LOW one. Artificial lighting can make the night brighter. A LOW night usually has little or no visible horizon, but if flying towards cultural lighting, a horizon may be very bright.

Moisture or haze in the air can reduce visibility severely. It reduces visibility by lowering the amount of moonlight reaching the ground, by reducing the level of the reflected light reaching your eyes, and by scattering light making shapes and outlines fuzzier and more difficult to distinguish. The ease of conducting low level flights also depends on the terrain being overflown. Take this into account when planning night missions.

With these limitations in mind a brightness calendar can be constructed as is recommended in chapter 3 of TC 1-28. Figure 5 is such a calendar for Ft. Rucker for October 1976. Its construction is easy as soon as you become proficient using the Air Almanac and a globe to answer the question, "How high the Moon?" For the period of time between the end of evening twilight and beginning of morning twilight, determine the brightness level for every half hour. Mark these brightness levels on a graphic format as shown in figure 5. As you begin constructing such a calendar you will notice that it is not necessary to go through the entire procedure for each half hour. For example, once the brightness level is HIGH you know it will remain HIGH that night until the Moon drops lower in the sky. How much lower can be estimated from figure 4 and a quick glance at its progress over the globe.

Now, for those that have calculators with trig functions, here is how to figure Moon altitude using your favorite hand-held electronic wizard. Simply plug the appropriate numbers into the following formula:

Alt =ARCSIN [COS (GHA-Long)COS(Lat)COS (Dec)+SIN(Lat)SIN (Dec)]

Alt - The height of the Moon above the horizon in degrees

GHA - The longitude of the spot on the Earth the Moon is overhead. This comes from the Air Almanac as in the globe procedure.

Long - The longitude of your location

Lat - The latitude of your location. If your location is north of the Equator enter the Lat as a positive number. If you are south of the Equator enter the Lat as a negative number

Dec - The latitude of the spot the Moon is overhead. Again, this comes from the Air Almanac. As with Lat, a south Dec should be entered as a negative

Below are the calculations for the example above:

Alt =ARCSIN [COS(133°-86°) COS(31°)COS(-12°)+ SIN(31°)SIN(-12°)]

Alt =ARCSIN [(.68)(.86)(.98) +(.52)(-.21)]

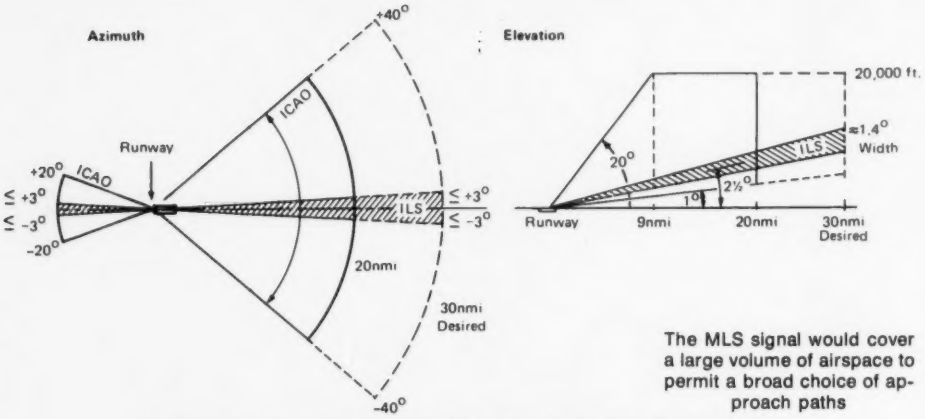
Alt =ARCSIN [.57-.11]

Alt =27°

Twenty-seven degrees is the same estimate of Moon altitude we got using the globe, and brightness again is found using figure 4.

Whether you use a globe or a calculator along with the Air Almanac, you can find "How high the Moon." Along with the fraction of the Moon illuminated and a brightness chart (figure 4) you can answer the question, "How bright the night?" Clear night brightness levels can be determined for every night months in advance and brightness calendars (figure 5) constructed. The planning of night training exercises or tactical missions can be done in a more informed manner to maximize the value of the operation. Weather, terrain and mission requirements also should be carefully considered in night mission planning along with predicted brightness.

Microwave Landing System *Continued from page 5*



The MLS signal would cover a large volume of airspace to permit a broad choice of approach paths

Coverages Recommended, Compared to ILS Coverage

Figure 3

heavy precipitation. Furthermore, it's becoming increasingly difficult to maintain these aging precision approach radar systems because of the dwindling supplies of replacement parts and the high cost of training qualified operators. Also, GCA provides only a single, narrow final approach path.

The single approach path is one of the major limitations of ILS. Aircraft flying ILS approaches must line up with the runway several miles out and fly the straight-in ILS glide slope down to the concrete. In effect all the planes are channeled into the same groove (figure 3).

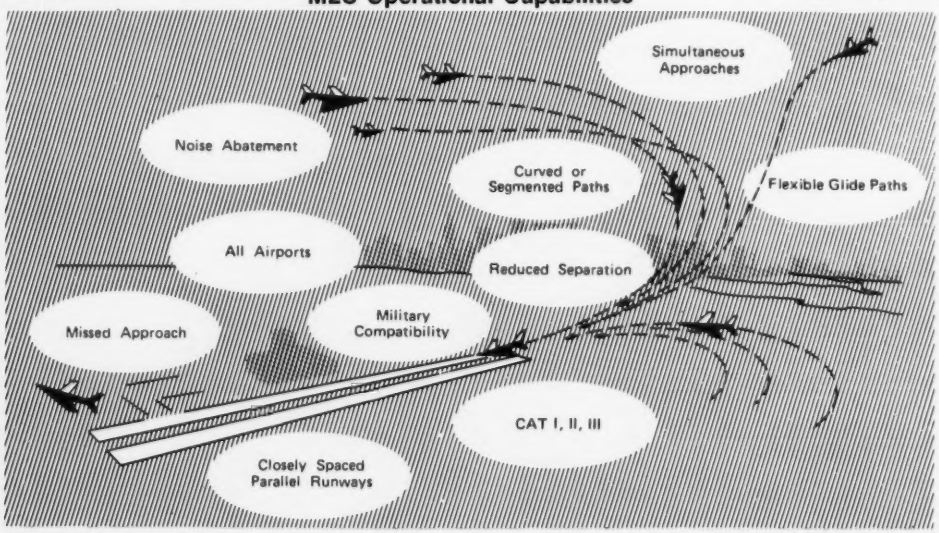
In addition ILS operates in the VHF (very high frequency) spectrum which means its signal is much more subject to interference than the higher frequency MLS equipment. ILS has a total of only 40 available channels which severely limits its future growth, especially in congested areas. Finally, due to sighting limitations, it is not always possible to install an ILS without first moving mountains (or at least large hills). And, in many places it isn't possible to install an ILS at all.

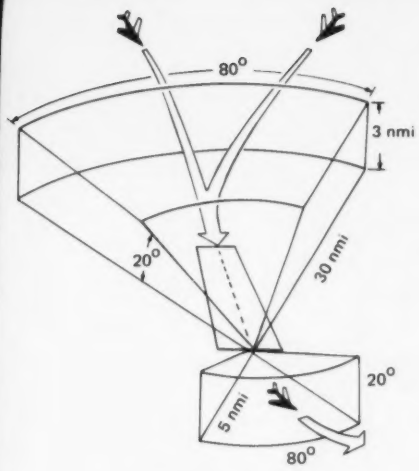
But now comes MLS with multiple approach paths, almost no problem from terrain interference and adverse weather, far more radio frequencies and the capability for quick assembly in rough conditions for tactical use (figure 4). Who could ask for anything more? The experts say that no one can—and that's why the MLS is expected to meet aviation needs into the next century.

One of the principal advantages

Figure 4

MLS Operational Capabilities





Coverage Volumes

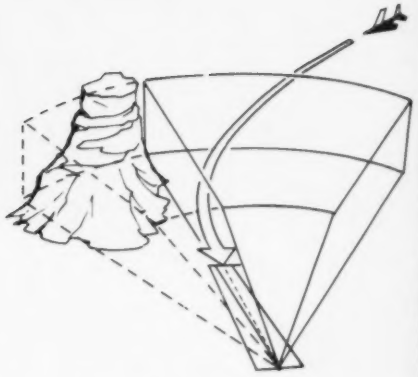
Figure 5

A major advantage which the large coverage volume affords is a variety of approach paths to enable more efficient use of airspace and noise abatement procedures. An option is the additional coverage volume for back azimuth

of MLS is that it generates a signal that acts like a wide mouth electronic funnel into which an aircraft can enter and make almost any curved or segmented approach to the runway limited only by the performance of the aircraft and the avionics installed. These approaches can begin up to 40 degrees to either side of the extended runway centerline and up to 20 degrees on the initial glide slope (figure 5). The ability of aircraft to make curved approaches with MLS will give air traffic controllers much more flexibility in managing incoming aircraft, permit them to keep aircraft away from residential areas for noise abatement purposes and help increase airport capacity (figure 6).

Because MLS operates in a higher frequency range it is far less susceptible to signal interference. With some 200 channels available MLS has almost unlimited growth potential.

By at least one measurement the military services promise to be one of the biggest MLS customers. There are 20,000 aircraft in the military fleet and the majority of them, or their replacements in the years ahead, probably will be equipped with MLS receivers. This contrasts with commercial airliners which today number only about 2,500. But it also is expected that a large number of the 160,000 general aviation aircraft owners will opt for the equipment. There are a great many military airfields where MLS is likely to be installed. The Army intends to replace all GCAs, which today number 54 at fixed Army airfields, with an even larger number in tactical use. The Air Force anticipates a need for some 200 MLSs at more than 100 Air Force bases—a number of which have more than one GCA. And, the Navy and Marine Corps have 54 air stations using GCA, all of which will become MLS candidates. The Army plan further calls for installation of airborne MLS in its new fleet (Utility Tac-

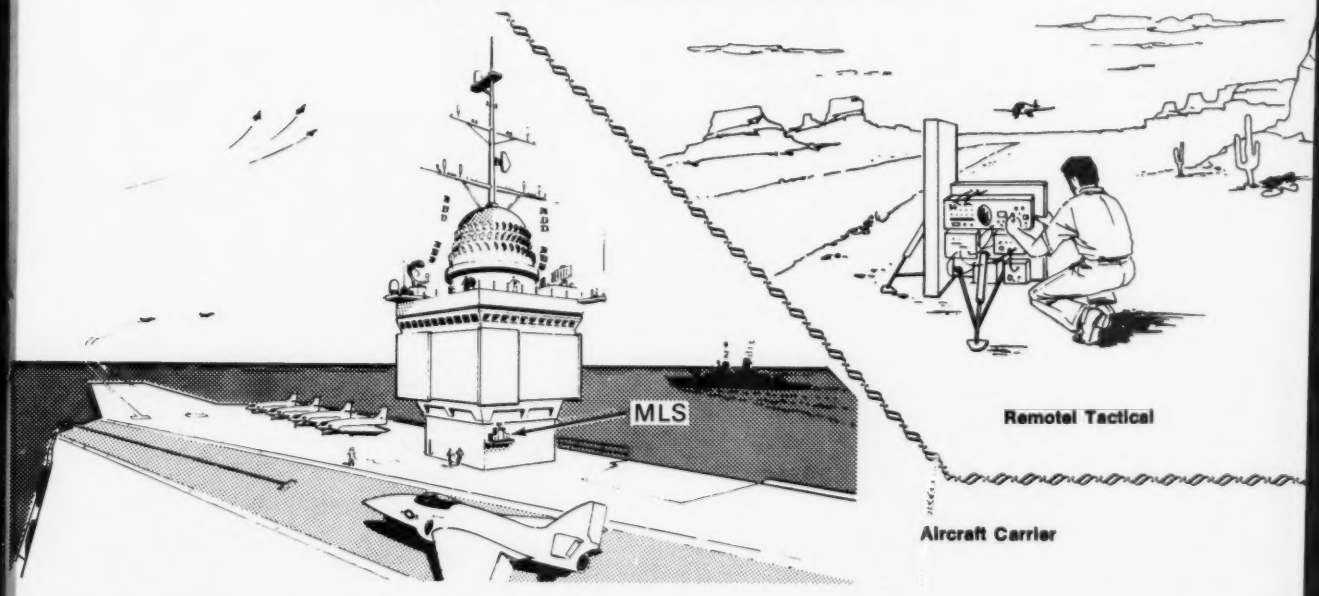


Coverage Control

Figure 6

Figure 7

Typical Military Ground Station Configurations



tical Transport Aircraft System, Advanced Attack Helicopter) as the avionics become available in the early 1980s. About 500 aircraft in the existing Army fleet will be retrofitted the first year (1977), 1,000 the second year, 1,500 more the third year and 1,000 or more each year thereafter until the fleet is fully equipped with MLS avionics. Along with its implementation plans the Army has been testing a flight director display system that could be used with the MLS.

The overall Department of Defense MLS program calls for the development of a so-called "milspec" version of MLS. These will be rugged, portable, easy-to-set-up ground units for tactical use in the field by the Army, Air Force and Marines. Another MLS version will be designed for use on aircraft carriers (figure 7).

The U.S. MLS employs a time-reference scanning beam (TRSB) technique that was chosen over the Doppler technique after a lengthy competition involving as many as six companies. The final selection followed an extensive evaluation of the two techniques involving some 120 experts from Government, the military, industry and other nations. Then an MLS steering committee composed of 17 members—including two each from the Army, Navy and Air Force—voted to recommend the time-reference scanning beam system.

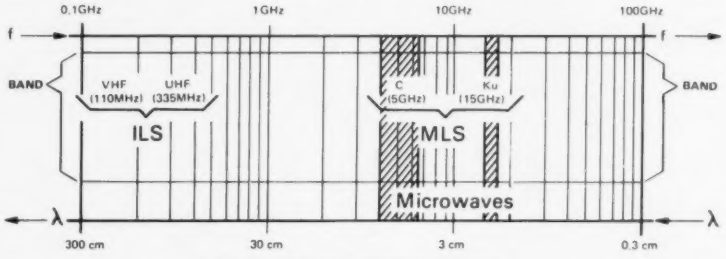
Finally, early in 1975, an interagency MLS executive committee of DOD, DOT and NASA representatives ratified the recommendation. By this action the U.S. committed itself to submitting a scanning beam design to ICAO.

Technical data in support of the U.S. design was submitted to ICAO in December 1975 and as noted a decision is expected in the first half of 1977. MLS, as its name implies, will operate at "C" band in the microwave portion of the radio frequency spectrum (figure 8).

Figure 8

Spectrum Allocation

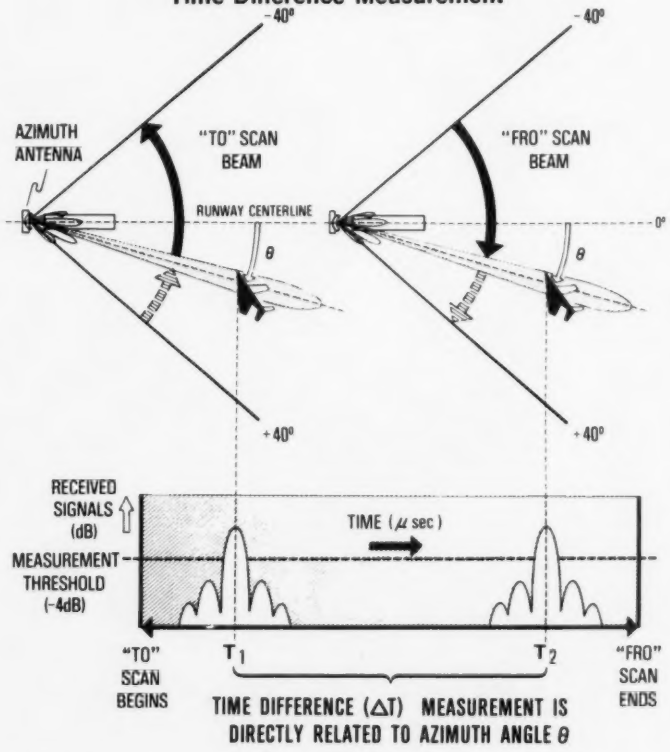
The operating frequencies would be microwave in the C-band, with provisions for the use of Ku-band for the flare maneuver (if required), and for special military transportability requirements



The time-reference scanning beam technique utilizes *scanning beams*, which refers to the method of sending out two fan radio beams from the runway, one scanning side to side, and the other up and down. *Time-reference* means that equipment onboard the aircraft will measure the time difference between successive "to" and "fro"

Figure 9

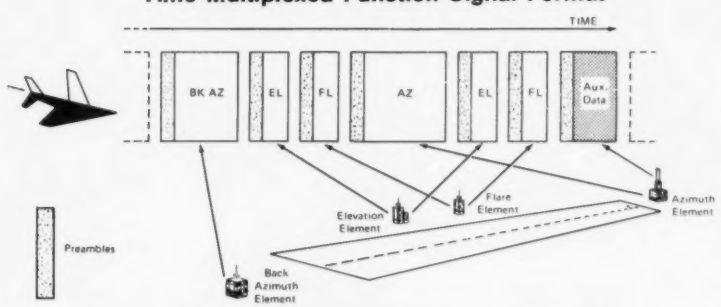
Time Difference Measurement



$$\theta = \frac{\Delta T - T_0}{}$$

Figure 10

Time-Multiplexed Function Signal Format



TRSB employs a time-multiplexed signal format. Time multiplexing is used to separate the various angle and data functions; that is, the transmissions from the various antennas are sequenced in time

sweeps of the scanning beams to determine the plane's position relative to the runway centerline and to a preselected glide path (figure 9). The TRSB employs a time multiplexed signal format. This means that the signals for azimuth and elevation and additional functions like backcourse azimuth and elevation and auxiliary data, are all transmitted on the same frequency in a certain time sequence (figure 10).

In May 1976 FAA received ground and air prototype equipment built by Bendix and Texas Instruments. FAA expects to give two MLS airborne receivers each to the Army, Navy, Air Force and Marines so that both FAA and the military services can collect data on MLS performance. The Army will fly its tests in an experimental UH-1B Huey equipped with flight director and autopilot as well as in a UH-1H helicopter and possibly a U-21 UTE (fixed wing aircraft). This supplementary data will be given to ICAO for its consideration.

FAA officials say they are "thinking positive." If the U.S. design is selected by ICAO as the international standard, the MLS prototypes will be crucial to development of production line systems. If not the prototypes will become sophisticated electronic curios.

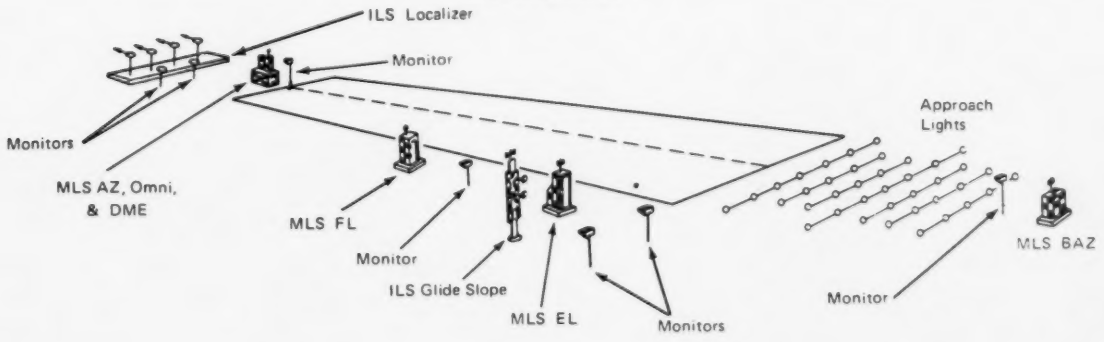
The coming of MLS will not immediately wipe out existing landing systems. Installation of the first MLSs in 1978 will usher in a period of 20 years or so in which MLS gradually will replace ILS and GCA. When decisions are made to replace nonprecision TACAN (tactical air navigation) landing aids at specific locations, MLS will certainly be the choice. In the years ahead GCA may well "coexist" with MLS at some military airfields until the entire military aircraft fleet is converted to airborne MLS receivers. On the civil side FAA has a similar scheme in mind—collocating MLSs with ILSs in many locations until the airlines fully convert to MLS (figure 11).

No matter what nation wins the ICAO competition, MLS eventually will be everybody's precision landing aid. And purely on its technical merits, MLS will do a better job.

Figure 11

MLS—ILS Collocation

MLS-ILS collocation has been anticipated. It will be many years before ILS is phased out; meanwhile, MLS will become operational within the next 5 years. During the overlapping operational period, the two systems must coexist at many airports. Therefore, collocation problems have been investigated in depth and are considered essentially solved



". . . scientific results cannot be used efficiently by Soldiers who have no understanding of them, and scientists cannot produce products useful for warfare without an understanding of the operations."

Theodore Von Karman
Charter Chairman of the USAF
Scientific Advisory Board

The Pilot and the Weather Forecaster

Lieutenant Richard H. Dickinson
Detachment Forecaster
Det. 2, 16th Weather Squadron, USAF
Fort Belvoir, VA

"WHAT WE ARE looking at here is a lack of communica[tion]s." This may be a tired cliche, but it too often is applicable in pilot-to-forecaster relationships. The communications gap usually results in confusion, occasionally in angry confrontations between the pilot and forecaster, and potentially in tragedy.

As an Air Force (AF) meteorologist at an Army airfield I have

FLIGHT WEATHER BRIEFING

I. MISSION

DEP/ETD	DEST/ETA	ALTN/ETA	BRIEFING NO.	DATE	ACFT/NUMBER
1300 Z	1330 Z	Z	.	15 SEP 75	48/3838

II. TAKEOFF DATA

RUNWAY TEMP °C	DEWPOINT °C	SFC WIND	TEMP DEV °C	PRESSURE ALT FT	DENSITY ALT FT	RCR

CLIMB WINDS

LOCAL WEA WARNING OR MET WATCH ADVISORY: ISLTD TSTMS IN LOCAL FLYING AREA

REMARKS/TAKEOFF ALTN FCST: NONE

III. ENROUTE DATA

FLT LEVEL: 060

FLT LEVEL WINDS/TEMP: 2515 +15°C

CLOUDS AT FLT LEVEL: ☐ YES ☐ NO ☒ IN AND OUT

MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS: 5 MILES, DUE TO ☐ SMOKE ☐ DUST ☒ HAZE ☐ FOG ☐ PRECIPITATION ☐ NO OBSTRUCTION

MINIMUM CEILING	LOCATION	MAXIMUM CLOUDS TOPS	LOCATION	MINIMUM FREEZING LEVEL	LOCATION
1000 FT AGL	VCNTY TSTMS	250 FT MSL	ENRTE	120 FT MSL	RIC

THUNDERSTORMS

MWA NO. 15B

☐ NONE ☐ AREA ☒ LINE

☐ ISOLATED 1-2%

☐ FEW 3-15%

☐ SCATTERED 16-45%

☒ NUMEROUS-MORE THAN 45%

HAIL, SVR. TURB. SEVERE. ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.

LOCATION: VCNTY RIC

TURBULENCE

CAT ADVISORY Z

	NONE	IN CLEAR	IN CLOUD
LIGHT		X	X
MOD			
SVR			
EXTREME			

LEVELS: SFC-100

LOCATION: ENRTE

ICING

NONE X

	RIME	MIXED	CLEAR
TRACE			
LIGHT			
MOD			
SVR			

LEVELS

LOCATION

PRECIPITATION

NONE X

	DRIZ	RAIN	SNOW	SLEET
LIGHT				
MOD				
HEAVY				
SHWRS				
FRZG				

LOCATION

IV. TERMINAL FORECASTS

DESTINATION	CLOUD LAYERS	VIS/WEA	SFC WIND	ALTIMETER	VALID TIME
RIC	30SCT 250VC	6H	2408	29.98 INS	1330 Z TO 1430 Z
	INTER 10 OVC 3TRW 2920G30				
ALTERNATE	N/R			INS	Z TO Z
INTMED STOP OZR	30 SCT	7	2006	30.04 INS	1600 Z TO 1800 Z
INTMED STOP				INS	Z TO Z

V. COMMENTS/REMARKS

POSSIBLE TORNADOS VCNTY RIC

VI. BRIEFING RECORD

BRIEFED ON LATEST RCR FOR DEST AND ALTN ☐ YES ☒ NOT AVAILABLE

REQUEST PIREP AT X

SEE FLIMSY NO.	WEA BRIEFED	FORECASTER'S SIGNATURE OR INITIALS
	1200 Z	ILT J. DOE

WEA FCLTY	TAPE NO.	START Z	STOP Z	PHONE CHARGE

VOID TIME 1330 Z

EXTENDED TO Z

WEA REBRIEFED AT Z

FORECASTER'S INITIALS

NAME OF PERSON RECEIVING BRIEFING

DD FORM 1 JUL 73 175-1 REPLACES EDITION OF 1 JUN 70, WHICH WILL BE USED.

AIRFIELD FLIGHT OPERATIONS OFFICE COPY 1

PHENOMENA	FOR ROTARY WING	FOR FIXED WING
Thunderstorms	Within 10 NM (nautical miles) either side of route and location	Within 50 NM either side of route and location
Turbulence (Not associated with thunderstorms)	Within 10 NM either side of route and ±1,000 feet of flight level and location	Within 50 NM either side of route and ±5,000 feet of flight level and location
Precipitation & Icing (Not associated with thunderstorms)	Same as with turbulence	Within 10 NM either side of route of flight and ±5,000 feet of flight level and location

encountered some of the problems created by this lack of understanding. Usually, problems come about because either the pilot or forecaster underestimates or overestimates the capabilities and limitations of the other. Often the pilot or the forecaster is not aware of the regulations and requirements that bind the other.

Some pilots, for example, think that the forecasts put out at their local weather station are prepared elsewhere, and all the forecaster does is pass on the information. But, all AF meteorologists are trained for 9 to 12 months by Air Force as well as civilian institutions in meteorological principals and forecasting techniques. After assignment to a weather detachment the forecaster must satisfactorily demonstrate proficiency to the detachment commander before being permitted to work the counter alone. The pilot should have a fair degree of confidence in the forecaster's ability to formulate forecasts and to tailor them for the pilot's route of flight.

On the whole I have found that relationships between pilots and forecasters are good. Low flying Army pilots are more interested in the weather than their high flying AF counterparts and the AF meteorologist appreciates having someone who will listen. Mutual respect and good-natured teasing characterize the pilot to metro association.

When the friendly atmosphere breaks down it generally is a lack of communication on the part of both parties. Each should be aware of the other's problems. By increasing the flow of information we should be able to better understand our problems and thereby increase mission efficiency.

By far, most errors involve DD Form 175-1. Since the forecaster sees the same errors over and over again, these become the most irritating (except for the occasional spouse or two who call up to find out if it will rain or not so they can decide whether or not to take the kids to the swimming pool).

Form 175-1 is a useful method of organizing data and presenting it to a pilot in concise, coherent form. Like all forms and regulations, however, it cannot cover all contingencies and the pilot should listen to the forecaster going over the 175-1, since anything not noted on the form will be elaborated upon verbally.

To make the best use of the 175-1 the pilot must understand it. Considering the number of weather briefings that a pilot receives, it is frightening to know how many pilots cannot read or prepare a 175-1. Perhaps we should go through a 175-1 section by section and point out chronic problem areas. See the figure on page 25.

Section I—Mission:

Dest/ETA: Enter the time of arrival at your *first* stop, regardless of flight time. Even if you are picking up passengers at a helipad 5 miles away from the airfield and then proceeding on a 2-hour flight, your destination is the helipad.

Acft/Number: Enter the *type* aircraft as well as the last four digits of its serial number.

Section II—Takeoff Data: There are generally no problems here.

Section III—Enroute Data:

Clouds At Flight Level: As a matter of interest, "in and out" represents a flight through clouds between 1 and 45 percent of the time.

Minimum Ceiling: This is the *height* in feet above the ground.

Maximum Cloud Tops & Minimum Freezing Level: Enter the height in *hundreds of feet* above mean sea level.

Thunderstorms; Turbulence; Icing; Precipitation: Note that a pilot flying 45 miles ahead of and parallel to a line of thunderstorms will have the "numerous" block checked in the thunderstorm part of section III, even though the forecaster doubts that the pilot will ever see one. This is one case in which it pays to listen to the forecaster elaborate verbally on the 175-1. Naturally the same problem can occur in turbulence, icing and precipitation (figure above).

Section IV—Terminal Forecasts:

Destination: As with the ETA the destination is the *first* stop. Subsequent stops are entered in the "INTMED STOP" blocks. Many pilots find this confounding. In this case, the pilot is picking up passengers in Richmond, VA, and flying on to Ft. Rucker.

Cloud Layers: The old symbols for cloud cover, ⦶, ◍, ⊕ have recently been replaced with SCT, BKN and OVC, respectively.

SFC Wind: Gusts spreads cause considerable confusion. "20G30" means the 1-minute average

windspeed is 20 knots with peak gusts to 30 knots. It does *not* mean that the gust spread is 10 knots. The gust spread is the variation of windspeed between peaks and lulls. In this case the wind could drop to 10 knots and gust to 30 for an average windspeed of 20 knots and a gust spread of 20 knots.

Section V—Comments/Remarks: There are generally no problems here.

Section VI—Briefing Record: *RCR:* Runway condition reading. *Void Time:* The void time expires 1½ hours after the time of the briefing. Don't get a weather briefing 2 hours before your time of departure. No forecaster wants to go through a 175-1 with a pilot, only to have to repeat it later.

Finally, if there is something that you do not understand ask questions.

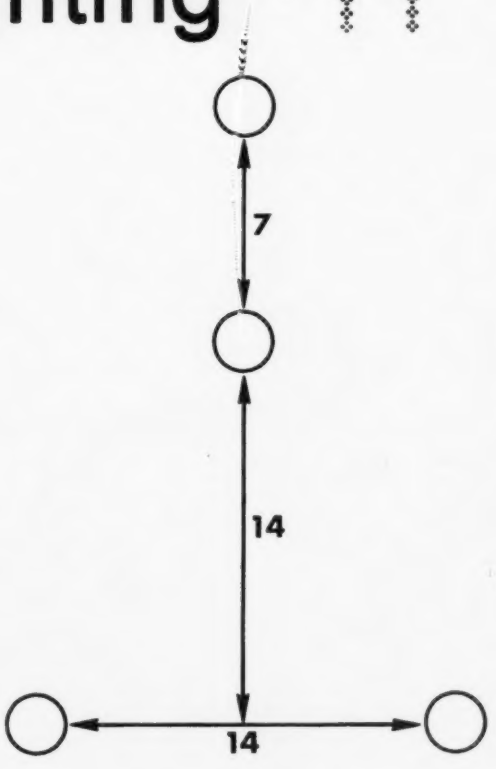
The pilot and forecaster both can benefit from a close working relationship. By keeping each other informed of the other' problems we can both accomplish our missions more efficiently. The pilot should be aware of the limits of the forecaster, yet still respect the forecaster as a professional capable of providing good weather advice. Further, the 175-1 is a useful form if the pilot understands it, but it is not the last word in pilot to metro communications.

Tactical Lighting

(Reference TC 1-28)

SINCE TC 1-28, "Rotary Wing Night Flight" was released to the field several inquiries have been made pertaining to the spacing between lights for the inverted "Y" used in night operations. The spacing is not depicted on the drawing on page 5-9. The recommended lateral separation between the two front lights is 14 paces. The linear separation between the front two lights and the first light forming the stem is 14 paces. The distance between the two lights of the stem is seven paces. (See diagram at right.)

The inverted "Y" was developed by a study group conducting research on night flying techniques at the U.S. Army Aviation Center. The Aviators conducting the test found the inverted "Y" to be an improvement over the standard "T." Although both lighting configurations were presented in TC 1-28 the inverted "Y" will become the standard tactical lighting configuration. Each of the services has adopted the inverted "Y" and it is anticipated that NATO will accept it as the international standard tactical light system.



Air Traffic Controller Of The Year For 1976

A noncommissioned officer credited with averting a possible disaster of an aircraft with a one-star general aboard has been selected as the U.S. Army Air Traffic Controller of the Year for 1976. Sergeant Lewis, who is dual facility rated, is shown above monitoring radar at the Kitzingen Army Airfield Detachment, Germany

STAFF SERGEANT Steven A. Lewis of the 14th Aviation Unit (Air Traffic Control) in Germany, was chosen Controller of the Year for 1976 from among some 1,700 air traffic controllers worldwide. The 14th Aviation Unit is an element of the 5th Signal Command, headquartered at Worms, Germany, a subcommand of the U.S. Army Communications Command (USACC).

The "save" occurred 13 March 1975, shortly after SSG Lewis arrived at the Kitzingen Detachment in Germany from Ft. Rucker, where he was an air traffic control instructor. A sudden change in the weather in the Kitzingen area caused an Army Aviator operating under visual flight conditions to become disoriented. He was uncertain of his location and ice began forming on the aircraft. SSG Lewis, on duty at the ground controlled approach (GCA) facility, located the aircraft and talked the pilot in—to a safe landing.

The flag officer aboard the aircraft, Brigadier General John K. Stoner Jr., commander of the 2d Support Command in Germany, commended SSG Lewis on his skill and professionalism and took the sergeant and his crew to dinner. The dinner was followed by a letter of appreciation and a certificate of achievement from General Stoner.

On another occasion SSG Lewis was able to avert an accident when a pilot called in that he was on an approach to the Kitzingen field. SSG Lewis checked the GCA radar screen and advised the pilot that he was actually planning to land on Highway 8B. The incident reemphasized the complaints by pilots that the Kitzingen runway lights were being obscured by the brighter lights in the city. The problem was resolved by varying the intensity of the runway lights, which contributed not only to aviation safety, but also to the energy conservation program.

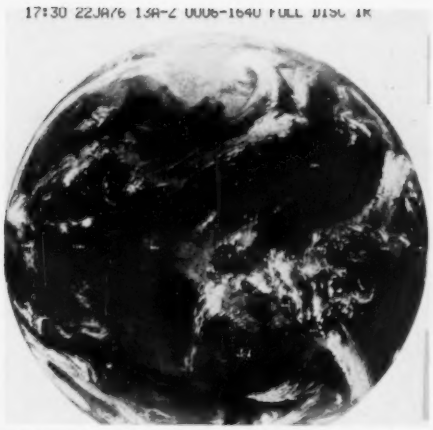
Other accomplishments cited in SSG Lewis' nomination for the year's top controller included:

• In late 1974, when he became chief of GCA at Kitzingen, the 14th Aviation Unit was given the mission of directing all Army air traffic control (ATC) in Germany. This meant that procedures, manuals and other ATC material were no longer valid. SSG Lewis quickly became familiar with allied ATC material, complicated German flight safety requirements and North Atlantic Treaty Organization (NATO) directives. He grasped the intricate requirements, deleted superfluous material and completely revised the GCA training manual for Kitzingen Army Airfield. The revised manual and procedures, coupled with what was described as SSG Lewis' "insight and grasp of the special needs of the local (apprentice) air traffic controllers," aided most of the trainees to quickly become facility rated.

• He became the first dual facility rated controller at the Kitzingen Detachment in the past 2 years despite the difficulty and delay involved since the Federal Aviation Administration (FAA) examiner was not a member of the 14th Aviation Unit. After receiving his dual rating (tower/approach control

Continued on inside back cover

SMS visible imagery produced by the WSMR DRGS at 1747Z on 22 Jan 1976



SMS infrared imagery produced coincident with previous visible image

Continued from page 3

. . .Satellites

dynamics and thus provide the information required to derive the weather which is going on below. This information is of particular importance in areas such as enemy territory where other sources of information may be denied.

For example, it already is known that severe weather phenomena such as turbulence, rain, hail, tornadoes, etc., occur primarily when the tops of storm clouds are descending. These phenomena generally are not in evidence when the cloud tops are building upward. Variations in the vertical motions of severe storm tops have periods on the order of a few minutes, with overall lifetimes of the storm ranging up to a few tens of minutes. These mesoscale motions are easily observable with SMS satellites. It is essential that observations be available at roughly 1-minute intervals in order to make the data useful for Army aviation in the battlefield areas.

ASL studies of meteorological satellite applications to Army aviation battlefield weather center on two projects titled "SATSEE" and "SATSTM." SATSEE is designed to provide a minute-by-minute knowledge of the cloud cover and visibility over the entire battlefield, with emphasis on enemy territory. SATSTM will provide a knowledge of the location, intensity and motion of all severe storms in the battlefield area. These data will be available to Army aviation users over an animated video display in the SATCOM ground stations developed for SATFAL.

Dr. Webb illustrates the thermal control mechanism of the 1,000-pound Defense Meteorological Satellite Program (DMSP) vehicle. Two of these satellites are maintained by the Department of Defense in sun synchronous polar orbits near 700 km altitude to furnish data over any location at 6-hour intervals

Deployment of the SATSEE and SATSTM systems can be expected to materially reduce the effort invested in reconnaissance to assure reasonable assessment of environmental conditions for Army tactical operations.

GLOSSARY

ASL	Atmospheric Sciences Laboratory
DCP	Data Collection Platform
DMSP	Defense Meteorological Satellite Program
DRGS	Direct Readout Ground Station
IR	Infrared
NESS	National Environmental Satellite Service
SATCOM	Satellite Communication Agency
SATFAL	Nuclear Fallout Prediction From Satellite Data
SATSEE	Meteorological Satellite Visibility System
SATSTM	Satellite Severe Storm Observational System
SMS	Synchronous Meteorological Satellite
VTPR	Vertical Temperature Profile Radiometric
WSMR	White Sands Missile Range

* * *

Balloonsondings: **Observing physical or meteorological conditions**
Mesoscale: **When concerning dimensions this refers to about 1 to 100 kilometers; when concerning time it refers to about 1 to 100 minutes**
Synchronous meteorological satellites: **Those satellites that appear stationary to the ground observer**
Synoptic observations: **Normal weather observations such as highs, lows, fronts, areas of rain, etc., over a broad area**

OPERATIONAL ASPECTS OF STRESS AND FATIGUE

Major William C. Wood, MD

DURING WORLD WAR I, little was known about and even less consideration was given to crew rest and flying fatigue. Consequently, aircraft accidents rather than combat losses caused the majority of aviator deaths. Chronic stress fatigue in World War I led to a syndrome of isolation, loss of appetite and poor sleep which in many cases was followed by accidents and death.

World War II saw improved concepts of stress and fatigue with the need for and implementation of regular "R&R." This war saw the use of night fighter pilots on a large scale, with the special problems and stresses of night flying and night air combat added to stresses of daytime flying. More sophisticated aircraft, prolonged overwater flights and high density antiaircraft action further added to the ever-present stresses of flying in combat.

The Vietnam conflict employed Army aviation in prolonged stressful conditions, thus requiring increased emphasis on crew rest, improved living conditions for aviation personnel and better operational conditions, whenever possible, for aviators.

Today, fatigue is still a cause of pilot-error accidents. The importance of stressful factors leading to fatigue and pilot error can only be estimated, but certainly must be one of the more important aspects to be considered in any unit aviation safety program. Unit commanders, flight surgeons, safety officers and all maintenance personnel are urged to emphasize stress and fatigue factors in operational planning and in unit safety programs. Lecture material on stress and fatigue is now incorporated in our nap-of-the-earth

USAAAVS

(NOE) pilot training program for the 1st Armored Division in Ansbach, Germany. This article presents some pertinent aspects of stress and fatigue which are being emphasized in our safety program.

Stresses of any type after a period of time cause fatigue, which is the reduced capability of the human organisms to react to a given situation. The types of fatigue, acute and chronic, have been well described in previous articles listed in the bibliography. Most fatigue in Army aviation is caused by multiple stresses, any one of which may be predominant. Our job in aviation safety is to isolate those stresses which can be eliminated and do away with them, to find those which can be decreased and reduce them, and to specify those which we cannot reduce or eliminate and teach aviators how best to adapt to them.

Table 1, a list of factors which contribute to fatigue, is an extract from an article entitled "Fatigue," which appeared in the February 1976 issue of the *AVIATION DIGEST*. (This table originally appeared in AGARD Advisory Report No. 69.) In addition, table 2 contains a listing of many factors involved in the everyday aspects of Army aviation which may cause fatigue. This table lists those stresses our division is especially emphasizing in our lecture material. Each stress listed in table 2 is carefully considered in detail during discussions with the pilots of our units. Unit commanders are briefed at intervals on stress factors which may be altered to improve aviation safety. NOE flying, generally considered to be the most stressful type of rotary wing flying, includes many of these stresses. U. S. Army Aeromedical Research

TABLE 1.–Items Contributing to Fatigue Ranked in Order From Most Important Through to Least Important

Instrument Flying	1
Exposure to Hostile Action	2
Limited Visibility	3
Sleep	4
Duration of Flying Duty Day	5
Monotony of Mission	6
Seating Comfort	7
Additional Duties Unrelated to Flying	8
Daily Rest	9
Aircraft Vibration	10
Low Level Flying	11
Night Flying	12
Aircraft Noise	13
Hunger and Thirst	13
Command Relationships	15
Adequacy of Ground Support	16
Morale	17
Dawn or Dusk Flying	18
Type of Terrain	19
Glare	20
Attitude Towards Mission	21
Interest in Mission	22
Avionics (Radios)	23
Navigation Instruments	24
Hovering	25
Emotional Outlet	26
Family Security	27
Aircraft Instruments	28
Cabin Lighting at Night	29
Relationships with other Military Personnel	29
Reliability of your Crew	31
Helicopter Limitations	31
Effort Required for Helicopter Control	31
Recreational Facilities	34
Aircraft Heating	35
Landing	36
Financial Security	37
Aircraft Reliability	38
Field of View from Cockpit	39
Takeoff	40
Social Relationships	40
Control Feel	42
Rotor Blade Movement	43
Flying Clothing	44
Intercom System	45
Fumes	46
Seat Belts	47

Compiled by the Advisory Group for Aerospace Research and Development based on a survey of 500 experienced helicopter pilots. Day or night NOE was not included in the list of factors for selection at the time of survey.

ASPECTS OF STRESS AND FATIGUE

TABLE 2.–Stresses in Army Aviation

1. Altitude stresses (including hypoxia)
2. Changes in speed (acceleration)
3. Temperature and humidity changes and extremes
4. Vibration
5. Cockpit environment
6. Aircraft handling and flight characteristics
7. Weather and night flying (including all IMC)
8. Circadian rhythm changes
9. Work/rest cycle changes
10. Meals and accommodations
11. Command responsibility
12. Ground organization and maintenance activity
13. Psychological problems
14. Medical conditions
15. Self-imposed stresses (diet, recreational activities, alcohol abuse, smoking, drugs)
16. Nap-of-the-earth flying
17. Anticipation, inactivity
18. A high accident and aircraft loss rate
19. Degree of aviator experience
20. Degree of recognition, praise and rewards to the individual and to the unit

Laboratory studies show that NOE flying is more fatiguing than standard rotary wing flying.

There is no good measure for flying fatigue other than that of decreased performance by the aviator. This again emphasizes how important it is for all persons involved in Army aviation to learn what to look for in the aviator to identify pilot fatigue.

Table 3, also an extract from the February 1976 article on "Fatigue," lists signs and symptoms of fatigue in general. Table 4 is a listing of those signs and symptoms of flying fatigue which our aviators are being asked to look especially for while flying and during off-duty hours. Overcontrolling and irritability are especially valuable indications of pilot fatigue in NOE flying.

Our current aviation safety program has attempted to teach aviators the signs and symptoms of flying fatigue and to reemphasize that it is characteristic of a fatigued pilot to deny being fatigued. We emphasize that it is the individual flying with the fatigued pilot who usually spots the fatigue.

TABLE 3.–Signs and Symptoms of Fatigue (Mental, Physical, and Physiological)

Physical exhaustion
Increased effort to carry out work
Increased rate of errors, especially at end of mission
Tenseness of body muscles; stiff neck; tremor
Tendency to doze; need of sleep
A feeling of "not being sharp"
Unusual difficulty in following instructions; things seem hazy
Need to recheck actions; uncertain about decisions
Diminished range of attention; deterioration in judgment
Acceptance of greater tolerances in instruments and controls
Acceptance of unnecessary risks
Vague headaches
Increased startle response
More frequent sighing
Irritability, fault-finding, impatience, temper flareups
Unusual preoccupation; forgetfulness
Sense of discomfort and failure
Boredom; loss of motivation; lack of group interest
Tendency to carelessness
Inability to concentrate
Increased reliance on coffee, tobacco, and alcohol
Loss of appetite and weight
Social withdrawal; resentment toward others
Nonconformity; asocial acts
Decreased personal cleanliness
Insomnia, nightmares, radical change in sleep habits
Confusion, chronic anxiety; fearfulness; depression
Vague chest pains, difficulty in breathing
Vague visual and/or auditory disturbances
Failure to integrate instruments as a unit
Unaware of errors and error accumulation
Splitting of complicated tasks into component parts

TABLE 4—Signs and Symptoms of Flying Fatigue

1. Overcontrolling
2. Irritability
3. Errors in timing
4. Overlooking important tasks in a series
5. Loss of accuracy and smoothness of control
6. Easy distraction
7. Preoccupation with one task component
8. Decreased attentiveness
9. Unawareness of performance deficiencies
10. Loss of correct sequences
11. Neglecting peripheral instruments and secondary tasks
12. A tendency to split complicated tasks and maneuvers into component parts
13. A growing inability to correctly interpret sensory input and an increasing susceptibility to vertigo
14. Slowed reaction time
15. Poor judgment
16. Poor appetite
17. Weight loss
18. Sleeplessness (often manifested by arriving early for duty)
19. Overindulgence in alcohol

The recommendations on flying hours in AR 95-1 must be reviewed by all aviation safety team members. Commanders are urged to rotate mission types among aviators and, in particular, to avoid assigning an excessive number of NOE missions to any pilot or group of pilots. The use of the copilot to aid the pilot, improved cockpit conditions, readily available aviation medical care and better environmental control, including improved field living conditions, are essential to reduce stressful factors which may eventually cause aircraft accidents. It is absolutely essential that commanders, maintenance personnel and flight surgeons participate regularly in NOE flights to understand and appreciate the special stresses involved in this type flying. Adequate rest and sleep is a crucial component of a unit's safety program.

A four-part article, "Human Factors in Nap-of-the-Earth Flying," by LTC Nicholas E. Barreca, is emphatically recommended to all individuals involved in Army aviation. This article together with the others listed in the bibliography should provide invaluable source material for unit safety presentations. Just as NOE flying is more fatiguing than other flying, so it demands increased safety surveillance by unit safety personnel. Considerable interest is now being shown in determining the proper duration of NOE flights and the interval of rest that should be required between NOE missions. Many articles on this subject are listed in the bibliography; however, further studies are urgently needed.

The changing concept of the employment of Army aviation, particularly its antiarmor role in a high intensity environment, indicates that NOE flying is here to stay. Increased emphasis on identification of stressful factors in NOE flying, reduction of these stress factors and command interest in reducing flying fatigue in NOE missions will pay rich dividends in lives saved and reduction of aircraft losses. All unit aviation safety programs should promote interest in these operational aspects of stress and fatigue and reemphasize these problems on a continuing basis.

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ARMY SERE TRAINING- YES OR NO, WHAT, WHERE AND WHO

TRADOC SCHOOLS AND training centers are required to teach Survival, Evasion, Resistance and Escape (SERE) subjects (AR 350-225). However, because of the "money crunch" certain types of training have recently been undergoing evaluation to determine their appropriateness for "peacetime." SERE falls into that category. Questions being asked are: 1. Should SERE training be continued at all? 2. If so, what aspects? 3. Where should it be taught? 4. Who should receive the training?

1. Should SERE training be continued at all? The general fiscal attitude toward SERE training is something like this: "It's good training, but what percentage of men become POWs? How can time and money for SERE training be justified when it applies to so few?" Only 476 of approximately 1½ million soldiers who served in Vietnam were captured or reported missing.

Discussing this question, a Navy flight surgeon paralleled this attitude with that concerning some types of medical research. Why spend so much money on researching cures for TB, cancer, polio and other diseases when only a relatively small portion of the total population suffer from them? The clear answer might depend on whether or not you're the victim.

LTC Floyd J. Thompson, one of the 476 POWs mentioned above, had this to say to General Creighton Abrams: "We were unprepared for what we had to face as a prisoner of war. After comparing notes with fellow POWs from the Air Force and Navy, we felt that we had been cheated." In other words, they were not fully trained or prepared for combat. Can we afford to drop peacetime SERE training and cheat those who will be first into the next battle, before an effective SERE program can be reimplemented? Consider the answer from the viewpoint of a "victim" who spent 8 years and 50 weeks in captivity pondering the point that neither the battlefield nor a POW camp is the place to learn basic SERE skills.

2. If continued, what aspects of SERE training should be taught? In 1954 Major G. N. Lam, a POW in Korea, stated: "The basis of all survival, whether you are evading through the hills or are a prisoner of war, is the will to live, to survive." From this we can see that a program encompassing a thorough approach to the basic principles and techniques of SERE, tailored to provide the confidence with which to bolster the inherent will to survive, is needed.

The key word is "basic." Basic survival is indigenous to all geographical locales of the world.

ARMY SERE TRAINING

Some aspects of survival, such as living off the land, should be treated as a separate subject, to be included in area orientations where it can be directed to a specific geographical area.

The same can be said for evasion training. The basic principles of travel and evasion are worldwide. The application of those principles to a specific geographical locale are best addressed in an area orientation aimed at a specific target audience.

Resistance training is a sore spot. We must accept the fact that there is no substitute for exposing soldiers to conditions similar to actual captivity and allowing them to prepare physically and mentally for capture. Most POWs will tell you that the psychological trauma experienced during the first few days of captivity is the worst part of capture.

We must expose our men to the basic treatment and exploitation techniques used against Americans in the past and the probable ones of the future. After exposure to these basics, applicable specifics can again be given in area or target enemy orientations. Both the basic and specific SERE training must be designed to make the soldier feel confident and combat ready, instead of totally fearful about capture. The greatest fear of the newly captured soldier is fear of the unknown.

Although actual living conditions and mental state could never be duplicated in training, this training must give the man the attitude that "I've been exposed to this and I know I can handle an actual situation."

Escape training should also be an integral part of a good SERE program. A POW should be so thoroughly trained that he continually thinks escape. He is mentally prepared to instantaneously exploit an unexpected escape opportunity, or with proper prior training and planning, create his own opportunity. Again, the basic principles apply worldwide.

3. Where should SERE training be taught? This question can be addressed in two ways. One is: In what geographical area should SERE schools be located? The other is: At what level should SERE training be taught?

First, the geographical areas. To the best of my knowledge there are currently four primary SERE programs operating under department sanctions. They are Navy Atlantic Fleet (Maine), Navy Pacific Fleet (Southern California), Air Force (Washington), and the somewhat smaller Army Aviation Center SERE Branch (Alabama).

These geographical locales are very appropriate, as CONUS is divided neatly into four quarters. Would it not be more economically feasible to expand the Army SERE effort, make it comparable in size, facility and doctrine to the sister services, and then have each school train all the appropriate service personnel in its geographical area, under the watchful standardized eye of the Department of Defense? To enhance standardization, SERE instructors could be assigned to any SERE school, regardless of service branch. Wouldn't this be less expensive than sending people TDY from Florida all the way to Maine, when the training is available in Alabama?

Secondly, the ground work for formal SERE training should begin in basic training and progress through AIT, NCOES basic and advanced, and the NCO Career Course, for enlisted personnel. It should begin in the basic course and progress through the advanced course and major staff and war colleges, for officers.

4. Who should receive SERE training? It is generally agreed that if you must conduct formal SERE training, it should be given to all high risk personnel. Who are they? Aviators, paratroopers, rangers, LRPs, special forces, pathfinders, etc. Now the problem between the WHERE and the WHO comes to surface. We all agree WHO, but the WHERE has at times caused problems Army-wide.

When the Army began letting (not necessarily authorizing) each target audience train its own personnel, it created an unhealthy situation. It allowed special forces, rangers, aviators, etc., to conduct their own SERE programs without standardization. As a result, SERE training deteriorated from a valuable training tool to no more than a fraternity-type initiation.

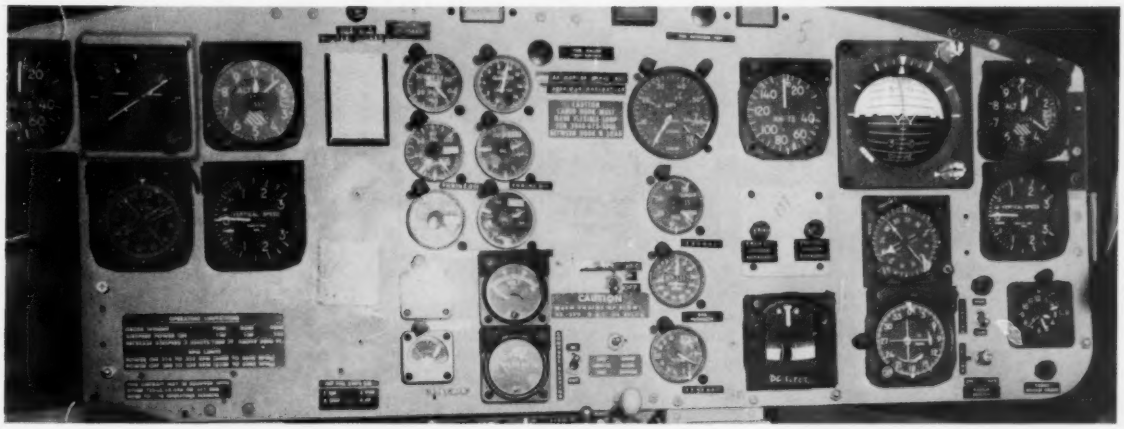
All basic SERE training should be conducted at a formal SERE training facility by competent and fully qualified SERE cadremen. Specific SERE orientations pertaining to exact target groups or locations should be conducted at user level, by formally trained unit SERE instructors.

We need more standardization among the services to determine who needs SERE training. Does a crew chief in the Navy need SERE training more than an enlisted crewmember in the Army? Evidently he does, because the Navy sends enlisted crewmembers to a formal SERE school for one week of intense SERE training, while the Army man gets 2 hours of SEE (Survival, Evasion and Escape) orientation.

SERE training in the Army has now reached a crossroad. It can continue straight ahead as it is, it can be "peacetimed" into hibernation, or it can be expanded and standardized both inter- and intra-service wise, to achieve the maximum benefit from this most important part of military training.

Major Charles Barr
From AEROSPACE SAFETY USAAAVS

HEY BLUE FOUR, I NEED HELP



I DON'T KNOW who first said it. Perhaps we would have to go all the way back to Francois Pilatre de Rozier to get to the source of origin. But there is a certain ring of truth to the age-old saying that flying is *hours and hours of boredom intermingled with moments of stark terror.*

Fortunately, our training and our aircraft systems give us, in most serious in-flight emergencies, the tools with which to cope and, more often than not, we are able to return our air vehicles to their intended point of landing with no more than another good bar story to be told. There is, of course, one very insidious malfunction that, given the right time and circumstance, could cause that moment of terror and might rather abruptly terminate your existence—said failure being that unrecognized attitude indicator failure.

Historically, Air Force aircraft average 100 attitude indicator failures per year. Fortunately, most failures are successfully dealt with in flight and therefore only remain incidents. However, over the last 6½ years we have had 11 accidents in which attitude indicator failure was identified as either causal or contributory.

There is nothing unique about attitude indicator failure, in that it can and does occur in all types of aircraft. What is unique is the total inability by some of our pilots to handle this emergency in flight. Fortunately the record shows that in the majority of cases this is not true.

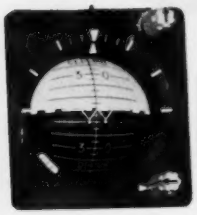
There are some good stories around about people who challenged the system and won. I personally know of a couple that are not reflected anywhere within Air Force records but still remain true. Both stories relate to bomber class aircraft and both by coincidence involve the island of Guam. For the first story we have to go back a few years, to the days when the B-47s were reflexing to this island.

The flight involved a night takeoff for a redeploy mission to the states. Takeoff roll was uneventful through liftoff at which time the instructor pilot recognized he had experienced an attitude indicator failure. In his own words, he knew it was no sweat and that he could handle it. In fact he did for a minute or two, on partial panel. He was actually feeling pretty good for this brief time period, knowing he had everything under control. Suddenly, from the rear cockpit, the copilot asked, in a typical copilot's voice: "Hey boss, what the hell is going on?"

The feeling of euphoria was broken, the instructor pilot realized he was in trouble and he informed the copilot that he had lost his attitude indicator and transferred control of the aircraft to him. Circumstances certainly played a significant role in this story. A night takeoff, attitude indicator loss detected at or near liftoff, the ability to detect the failure, adequate schooling in partial panel flying, an observant copilot who was willing to speak when he realized things were going from bad to worse quickly and, finally, the realization by the instructor that he was in trouble and needed help.

The other story occurred some years later, during the height of the Vietnam conflict and involves two

HEY BLUE FOUR, I NEED HELP



close personal friends of mine who, I hope, will forgive my relating this story here. The mission was a bomber deployment from the ZI to Guam. Shortly after coastout the first attitude indicator failed. In consideration of the forecast weather and daylight flying hours, the pilot, again an instructor, elected to continue the mission. Subsequently, with Hawaii under his wing tip, the second and last attitude indicator failed.

Here's the situation: both attitude indicators inoperative, destination weather forecast good, day visual meteorological conditions en route and an operative auto pilot. The decision: continue to destination. Judgment—not good, for two reasons: (1) everyone can use a day or two in Hawaii, and (2) the unknown 3,000 miles ahead.

Lady Luck was riding with this crew this day and, in fact, the trans-Pacific crossing was routine. However, at Guam—you guessed it—the weather was less than optimum. Much to the surprise of Guam Approach the pilot requested a no-gyro GCA which was immediately rejected with words similar to, "We don't approve practice no-gyro approaches here." And, I am sure Guam was equally surprised at the next response they heard crackling through their earphones: "Hey babes, I don't think you understand. This ain't for practice." Suffice it to say the approach was flown and the aircraft landed safely.

Can we challenge this pilot's judgment? Sure—I have and he has himself. What we can't challenge is his ability and his deeply founded understanding of partial panel instrument flying techniques, techniques gained through many hours of partial panel flying and simulation. Those techniques that were taught in the old school, of 15 years ago; that I'm not sure are being taught or practiced today.

There are of course those incidents where attitude indicator failures result in a castastrophic loss of life and equipment. It would be subjective on my part to say that, in all cases, the loss of the attitude indicator was detected in time to change the sequence of events leading to the accident. However, in one case, of which I am personally aware, this did occur. In that case the pilot, following a precessing attitude indicator, flew his aircraft into a bank/pitch attitude from which he was unable to recover. In my opinion more than adequate verbal/visual cues were being provided in that an excessive altitude loss was being announced (1,000 feet every 4 to 6 seconds) which should have alerted the pilot to some unusual problem. Additionally, a second pilot, as well as the first pilot, had access to a completely operable attitude indicator and yet they either disregarded or failed to note the differences between the two systems. As a result, the aircraft crashed and four lives were lost. Why? Loss of control, sure; but why loss of control? Perhaps a couple of reasons. One being that the initial attitude indicator failure was insidious in that no "off" flags were visible, and maybe the second was the inability to revert to a basic partial panel technique which probably could have stopped the sequence before it really got started.

There are other indications, in other aircraft, of this same inability to revert to basic partial panel flying techniques when loss of an attitude indicator occurs. In support of this argument let's review the following accidents:

The first concerns a flight of three on a day intercept and instrument training mission. Shortly after takeoff the lead aircraft entered layered clouds on established climb speed. While in the clouds the pilot intuitively felt something was wrong with the aircraft; however, he failed to immediately detect the source of the problem. He did, however, notice a 50-knot decrease in airspeed as he concentrated on maintaining a normal pitch attitude on his attitude indicator. As the airspeed was dropping through 300 KIAS the inertial navigation unit failure light illuminated and the attitude indicator tumbled. Aircraft control was transferred to the rear seater, a nonpilot, who was unable to recover the aircraft. Both crewmembers ejected successfully.

In another accident the aircraft, shortly after liftoff,

entered instrument flight conditions. Again the pitch attitude was established at 10 degrees nose up as the aircraft accelerated to climb speed. At approximately 250 KIAS the pilot noted flashing wheel lights and checked the gear indicators to confirm the gear position. While transitioning back to the flight instruments, the pilot indicated the aircraft felt strange. However, the attitude indicator still indicated a 10-degree climb. Suddenly, the pilot got quite light in his seat and informed his back seater that something wasn't right. Crosschecking his altimeter and vertical velocity, the pilot noted the altitude to be decreasing through 2,000 feet at between 500 and 1,000 feet per minute. Back pressure was applied to establish a positive climb rate as the aircraft broke through the clouds in a 5- to 10-degree nose-low, right wing-low attitude. Back pressure was increased and the nose rotated through the horizon just as the aircraft crossed a stand of trees. After tree impact, the aircraft was successfully flown above the cloud deck. With assistance from another member of the flight, a successful approach and landing was made.

Even more recently, one of our Air National Guard pilots experienced an attitude indicator failure during an annual instrument check. Whether the guy passed or failed the checkride is not important for this writing. But I feel the subsequent action taken by this wing is. Perhaps some small part of the story should be told so everyone has a clear understanding as to why the local experiment was conducted.

The examinee, in the rear cockpit, briefed the flight examiner (FE) prior to takeoff that, after liftoff, he would be lowering the hood and that any departure instructions given were to be followed by the FE until he (the examinee) was ready to assume control of the aircraft. After liftoff, departure control cleared the aircraft for a right turn of 50 degrees, on course.

The rear seat pilot secured the hood and assumed control of the aircraft, wondering why the FE had not initiated the right turn. Without crosschecking any other instrumentation, the rear seat pilot applied control pressures to establish the aircraft in a 30-degree right bank. At this time, he noticed the heading indicator turning while the attitude indicator was indicating a 15-degree nose up, wings level attitude. A partial panel unusual attitude recovery was attempted as he informed the FE of his attitude indicator loss. The FE recovered the aircraft from near 90 degrees of bank and aborted the flight without further incident. After this incident the unit modified their simulator folks so they could duplicate the exact sequence, without, of course, telling the pilots. Within one week, four of nine pilots tested crashed within 10 seconds after the malfunction was introduced. We are not talking about low levels of flying experience in this wing. The lowest man had 988 hours in aircraft type, while the high timer had over 5,500 total hours with 2,377 in type.

In the majority of the attitude indicator failures presented here some significant points come to light. First, in all cases where the pilot was trapped and needed help, instrument flight conditions existed. Second, the transition to other flight instruments was slow or nonexistent. Third, without visual reference to the horizon and/or a slow instrument crosscheck, an unusual attitude was encountered within seconds.

Well then, one might ask, where do we go from here? I wish I had an immediate answer, but I don't. Perhaps one suspect area is our training. In years gone by, we trained utilizing an instrument hood and at least occasionally on a partial panel; i.e., heading indicator, altimeter, airspeed indicator, turn and slip indicator and vertical velocity. Today this seems to be a lost art or, at least, has a minimum level of acceptance. However, the facilities are available for such training through simulation and at least one of our MAJCOMs has recently reinstituted just such training as an integral part of their flight simulation program. With regard to the instrument hood, I didn't like it when I was flying it and I think the decision by most MAJCOMs to do away with it was a valid one. However, in practicing instrument maneuvers without some restrictive device, one has a tendency to cheat, which I most sincerely discourage. The time to learn to fly good instruments is during VMC. All it really takes is dedicated effort and practice. This also is the time to learn to cope with such emergencies as attitude indicator failure. I still have a one-quarter inch plywood cutout, specifically designed to cover an attitude indicator, which was presented to me years ago by my first aircraft commander. Although I no longer use it, it's still a valid tool for teaching partial panel flying.

If your wing doesn't have a valid simulator instrument training program ask them to develop one. Hell, I've been out of control more than once in a simulator but, fortunately, never once in an airplane.

The ability to handle an attitude indicator failure depends uppermost on your own capabilities—with the key being the capability to recognize the malfunction. Sometimes it's easy in that the red off-flag is visible, sometimes it's not. Flight instruments are presented in a package and more cues are available than just those presented by the attitude indicator. However, those cues are not available without an instrument crosscheck, and, quite honestly, that's your best chance for survival. Work on it, practice every chance you get in both the simulator and in flight and, perhaps, rather than becoming a statistic, you too will have a good bar story to tell.

When it comes to your T53 engines, if you believe cleanliness is next to godliness; if you are a stickler for by-the-book maintenance; and if you always "try" before you "buy"; then you are giving professionalism—that old, overworked, exhausted word—a new lease on life, and all we can say is . . .

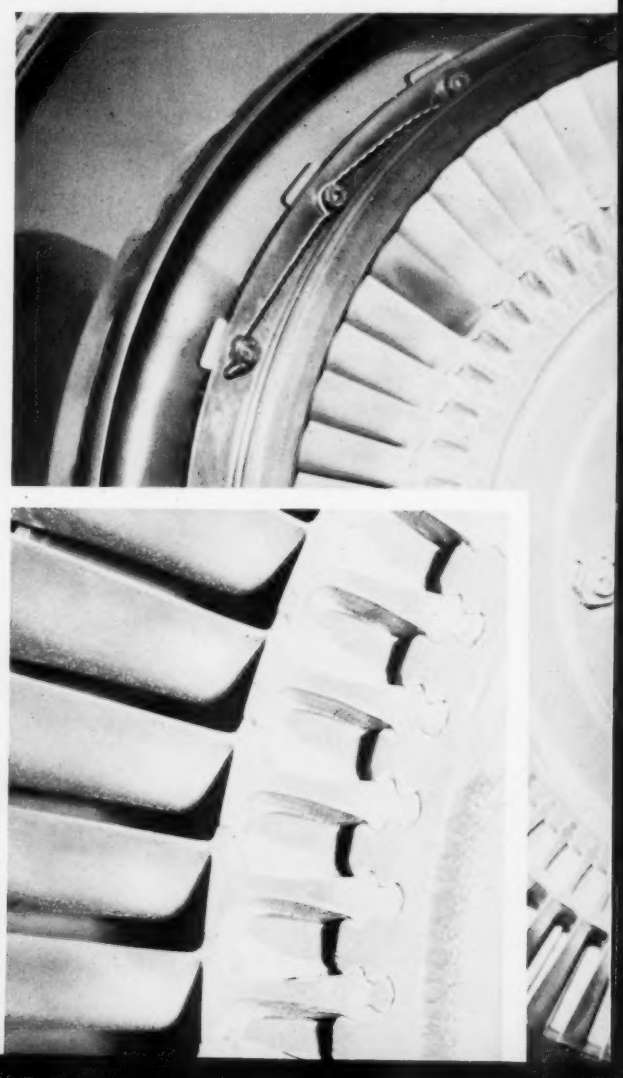
MORE POWER TO YOU!

IT'S NO SECRET that performance of both helicopters and gas turbine engines decreases as summer temperatures and density altitudes increase. We've known this fact for a long, long time. Yet, armed with this knowledge, we still find that as temperatures rise, so does the number of engine-related mishaps. Reports arriving daily at the U. S. Army Agency for Aviation Safety (USAAAVS) clearly show this to be true. Can this increase be attributed solely to pilot error or complacency? Human nature being what it is, a pilot may, on occasion, fail to consider the effects of heat and density altitude on his aircraft and engine; or he may fail to correctly evaluate the load he is attempting to lift. However, in most instances, this is not the case. The majority of the engines involved in these types of mishaps were simply not up to par, but they went right on working without registering any complaint—until they were asked to put out more than they were capable of doing in their sick condition. The result was surge, high egt, and in some instances, total engine failure—all because the engines hadn't complained and no one had bothered to ask them how they felt.

This gives rise to other questions. Why, if most of these mishaps are not pilot-error type, do they suddenly occur with a change from cool to hot weather? If an engine is sick, isn't it just as sick in the winter as in the summer?

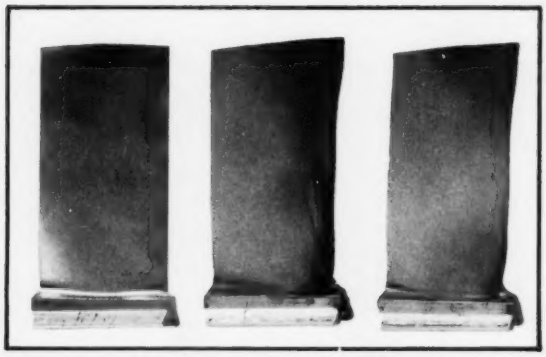
Erosion. Let's consider an engine suffering from compressor erosion—a potentially hazardous condition. Depending on the degree of erosion, the engine may not show any unusual symptoms and may perform normally, especially during cold weather. But should the outside temperature increase, the requirement for engine power will also increase. Since the air is less dense, engine efficiency will decrease. This means the compressor must now rotate faster to maintain proper compression at any given power setting.

Since compressor blades are actually "little wings," each functions aerodynamically in a manner similar to that of an aircraft wing. Erosion of these blades changes their shape and reduces their surface area. Just a few hundredths of an inch wear will significantly alter both their size and shape, rendering them in-



Right: Need for frequent particle separator inspection to ensure cleanliness and proper operation is emphasized by buildup of impacted dust along root area of these turbine blades

Clarence J. Carter
Directorate for Aircraft Accident Analysis and Investigation
U.S. Army Agency for Aviation Safety **USAAAVS**



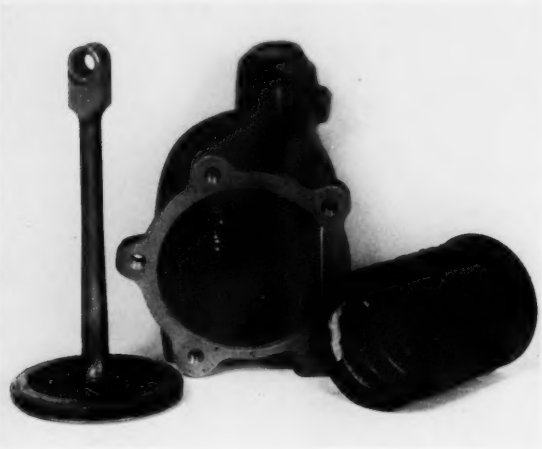
As can be seen by comparing new blade (left) with used one, erosion changes size and shape of blades, reducing their efficiency and drastically affecting gas flow and engine performance

capable of supporting the load they were originally designed to carry. When this happens, compressor stall becomes almost inevitable.

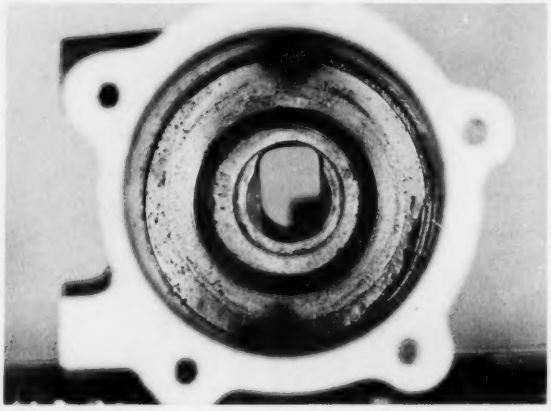
Because of the high velocities at which they operate, compressor blades are readily subjected to erosion when sand, grit or even small dust particles flow across them. To protect these blades, we rely on air filters and particle separators. These must be properly maintained and kept clean if they are to effectively do their respective jobs. Keep in mind that a properly functioning particle separator is, at best, only 70 percent efficient. This means that approximately 30 percent of *all* solid particles—large and small—that get past the filters and enter the separator will continue through the engine. And air coming out the purge line when the engine is operating does not ensure the separator is working properly. Engine compressor bleed air is directed to a venturi effect ejector mounted at the bottom of the lower half of the separator. If the port to the ejector becomes plugged, the separator will not purge, allowing sand and dust ingested to enter the engine. USAAAVS has numerous mishap reports on file in which an inoperative self-purging particle separator was a cause factor. In two of these instances, the lower half of each separator was full of compacted dust. Only the purge tube had been cleaned.

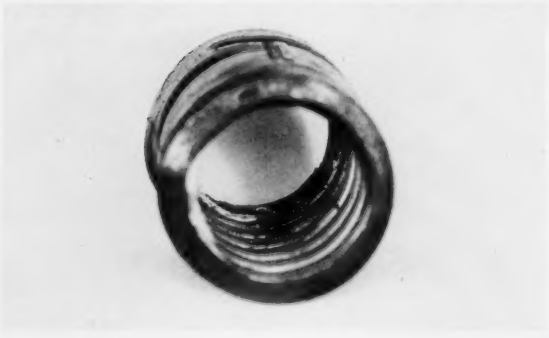
Unfortunately, because of high air velocity and pressure, the greatest erosion occurs first in the aft compressor stages where the smallest and thinnest blades are located. Once these blades become worn and lose their efficiency, a deceleration (decel) stall is likely to occur when power is reduced and the bleed band opens, causing a sudden increase in airflow velocity.

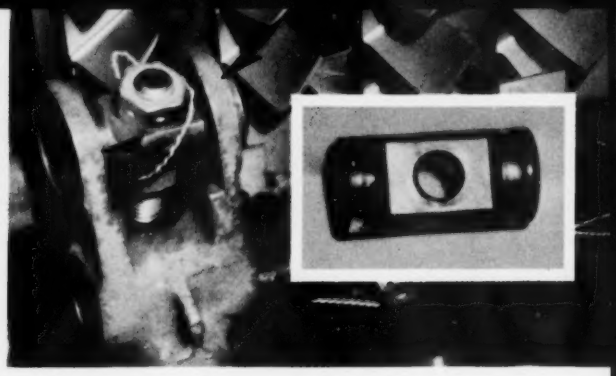
While the decel stall serves as a positive indicator that all is not well within the engine, it seldom causes damage. However, another type of stall that can occur when power is demanded poses a serious threat to the safety of both aircraft and occupants, and must be avoided. Not only can it force the aircraft down over an area unsuitable for a successful landing but also can cause mast bumping, structural failure and a castastrophic accident. Obviously, for maximum protection from erosion, the filters, particle separator and engine must all be properly maintained and kept clean. In addition, that portion of the engine that is visible should be inspected frequently for warning signs that might indicate an eroded compressor. This includes a check of the inlet guide vanes for a sandblasted or polished appearance, and the first stage compressor blades for any detectable erosion in the blade root areas. But erosion is only one of the major causes of compressor stalls. Others include im-



Above: Sticky B&B compound collects on top of piston, holds dirt and causes piston to bind and score cylinder. Below: Closeup showing compound and dirt collected inside return spring and cylinder







Contamination of the bleed band actuator housing assembly is not the only cause of sluggish or erratic bleed band operation. Dirt around this interstage bleed screw retaining shaft (arrows) caused it to bind, preventing proper operation.

proper variable inlet guide vane (VIGV) rigging and compressor bleed assembly operation.

Variable inlet guide vanes. Improper VIGV rigging has played a prominent role in compressor stalls associated with T53-L-13 series engines. And the most common corrective action has been replacement of the fuel control unit. In most instances, the reason this action cures the stall problem is because it requires rerigging of the VIGVs. Bear in mind that VIGV rigging can change through normal wear. This is especially true if an aircraft is extensively operated in a dusty nap-of-the-earth (NOE) environment. Since the exterior of the engine is not protected from sand and dust, the rapid continuous power changes required during NOE flight cause accelerated wear of all exposed linkages. As a precautionary measure, USAAAVS recommends all aircraft operated in an NOE environment be given a VIGV rigging check after every maintenance action that could affect VIGV rigging and after every 100 hours of flight.

Although paragraph 5-155b, page 5-90, TM 55-2840-229-24/T.O. 2J-T53-16, dated 23 April 1971, with 11 changes, explains the function of the variable inlet guide vanes and states one rigging method, USAAAVS recommends that the more precise method stipulated in paragraph 5-155f and subsequent subparagraphs be followed. This method requires use of a special switch and coupling kit. In addition, USAAAVS recommends the VIGV full open position be established at the upper limit of the allowable operating range to provide a safety margin during rapid power changes required by NOE flight. (Note: Figure 1-22, VIGV rigging chart, referred to in paragraph 1-78, page 1-26, is now listed as figure 5-69 and is found on page 5-94, change 11).

Compressor bleed assembly. This assembly which consists primarily of the interstage bleed actuator, bleed band, and attaching parts operates by compressed air in conjunction with the variable inlet guide vanes. Any binding, sluggish or out-of-phase operation during power changes will result in loss of power, high egt and often in compressor stalls. For proper operation, cleanliness is an absolute necessity.

In fact, most bleed band related compressor stalls have resulted from sticking or dragging of the actuator piston. This piston normally extends vertically out of the actuator housing. During engine cleaning operations, water, dirt and cleaning fluid can enter the housing from around the piston shaft if no protective measures are taken.

For safety reasons, TM procedures for cleaning the engine inlet area, inlet guide vanes and the compressor rotor blades must be accomplished in the sequence specified; and the caution which states that cleaning solution or water must *not* be sprayed into the engine inlet while the engine is running must be observed. A stream of liquid directed against the compressor blades at operating rpm can cause the blades to oscillate at a high frequency, resulting in fatigue damage to the blades and subsequent blade failure.

Stringent care must also be exercised to ensure that the water soluble cleaner (B&B 3100) does not enter the cabin heat system during engine cleaning operations. When heated, this cleaner becomes a powerful irritant, and the fumes emitted, if breathed or allowed to contact the eyes, can incapacitate the pilot during flight.

Closing the bleed band with a metered air source (not to exceed 60 psi) will prevent cleaning solvent from blowing out the bleed ports and entering the bleed band actuator from around the piston shaft. However, when the engine exterior is cleaned, USAAAVS recommends the entire bleed band actuator be inclosed with some type of waterproof material, such as a plastic bag wrapped with tape. Since the actuator is a "dry" assembly that requires no lubrication, any contaminants that are allowed to collect in the actuator housing can cause erratic operation of the bleed band.

Finally, to ensure correct operation of the bleed band, a closure check should be made, using the bleed band closure range charts. Again, for best engine performance, USAAAVS recommends that the bleed band be adjusted toward the upper limit of the allowable operating range.

Ensuring that no air leaks exist and that the three major engine areas discussed are properly maintained will collectively go a long way toward preventing compressor stalls, particularly those usually associated with hot weather operations. However, reliance on these efforts alone does not guarantee freedom from engine problems. FOD, for example, can result in engine failures and mishaps. So can improperly adjusted fuel control units.

Obviously, for maximum engine efficiency, performance, reliability and safety, *total* engine care is essential. This means that timely inspections thoroughly performed and by-the-book maintenance of all engine components and assemblies must be the rule. Yet, despite our best efforts, we cannot always identify every potential problem as soon as it begins to develop. However, we can keep a constant check on our engines for early symptoms of some malady that could, if neglected, cause serious in-flight problems. And we can do this safely and easily by use of the health indication test more commonly referred to as the HIT check.

In brief, this check consists of facing the aircraft into the wind, stabilizing the rpm and egt, then increasing N_1 to the proper value for the existing outside air temperature (OAT) as indicated by the chart on board the aircraft, and then noting and recording the egt. A variation of 20 degrees or greater from the base line temperature established for that engine requires an entry on DA Form 2408-13. Should the egt vary 30 degrees or more, the aircraft should be considered unsafe for flight.

The effectiveness of this check depends first on accurately establishing all base line data after ensuring the engine is in good health (regardless of engine operating hours); and second on the care exercised to ensure accuracy when performing the HIT check itself. A complete explanation of HIT procedures can be found in the engine technical manual for the aircraft.

Despite the effectiveness of properly performed HIT checks, it is important to keep in mind that this test monitors only those portions of the engine exposed to or affected by the gas flow path. HIT supplements spectrographic oil analysis, engine vibration checks, topping checks and other established engine maintenance procedures and is not intended to replace them.

Should you desire further information, call USAAAVS, Environmental Factors/Fixed Wing Division, Fort Rucker, AUTOVON 558-3913/3901.

If your engine could talk, it would summarize its needs in four short, simple statements:

- Keep me clean.
- Inspect me often.
- Maintain me correctly.
- Test me daily.

That sounds like good advice anytime. But during the hot summer months, it's more than just good advice—it's an ultimatum. Take it to heart, and as the title states, "More power to you!"

briefs that teach

assigned risk

The copilot was at the controls in the right seat of a UH-1H during a night training exercise. Arriving at the LZ, the flight made a steep approach to clear the surrounding trees. Feeling that the approach angle was too steep and the rate of closure too slow for a safe approach, the copilot executed a go-around by breaking out to the right. The other four aircraft in the flight continued into the LZ. The copilot made another approach to the LZ and was on short final as the other aircraft in the flight were lifting off.

After landing in the LZ, the pilot took the controls for takeoff. As the Huey cleared the tree line, the pilot turned off the landing light and turned left to rejoin the flight. After completing the turn, the aircraft was described by a ground witness as appearing straight and level and very low. It struck several large trees and climbed rapidly. As the pilot tried to regain control, he shouted instructions to the crew. The crew chief turned on the searchlight and the copilot attempted several mayday calls on the damaged UHF radio. After the crew chief turned on the light, he saw a clearing to the left and shouted to the pilot. The pilot attempted to land in the open area. He had no pedal control and the copilot assisted with the pedals. The aircraft touched down, rotated to the left and slid 12 feet before coming to a halt.

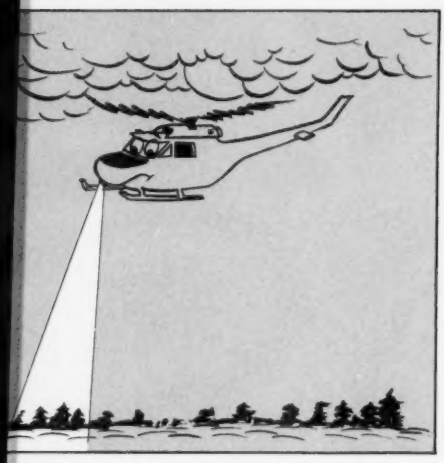
Command supervision was a definite cause factor in this case. **Two pilots with limited recent experience—and with significantly fewer hours than the average pilot in the unit—were paired to fly in the same aircraft. These aviators, with primary administrative duties, should not have been scheduled to fly together.**

Fatigue also played a part. Crew rest guidelines were not enforced and the pilot and copilot had been awake and on duty for more than 18 hours before the accident.

too little light

Three crews reported to the flight line before dusk for a night troop lift mission. The flight leader was in the left seat of Chalk 1. Two lifts were completed and the flight returned to home base. There they learned that one lift had been missed. The flight reassembled and left home base in a loose trail formation.

On final, Chalk 1 had trouble locating the landing zone (LZ), which was marked by only one light. The pilot decided that the approach would be too steep to be safely executed and made a go-around followed by a left turn. Chalk 2, following high and at a considerable distance behind Chalk 1, started a climb and lighted the LZ with a landing light. Chalk 3 saw Chalk 2 entering the clouds some 300 to 400 feet above him. Chalk 2 reported he was IFR and climbing. Chalk 3 still had him in sight and told him he was clear to descend. He suggested several headings that would ensure aircraft separation and began a right turn. Neither Chalk 1 nor Chalk 3 heard a response from Chalk 2. About



a minute later, the tower received a mayday call. Chalk 3 saw two white lights fall out of the cloud layer as Chalk 2 crashed.

Ground observers in the LZ judged that Chalk 2 entered IFR with his landing light on some 200-300 meters north of the LZ. His entry into IFR conditions was probably caused by his attempt to locate the landing zone. The light disappeared in the clouds after a few seconds.

The pilot failed to transition to full instrument flight when he entered IFR conditions. This was probably because he was looking for outside visual references while in a turn, with occasional cross reference to his instruments.

Supervision also played a part. The most experienced pilot in the flight was not given responsibility for assisting in the control of the flight. The crew of the crashed UH-1 consisted of a pilot with a total of 755 hours and a brand-new school graduate on his first mission. The LZ was not properly lighted because of a lack of coordination with the ground unit and additional lighting was not requested during the first attempted landing.

gross situation

A UH-1H crew was to fly several missions to transport passengers and supplies. The first flight was uneventful and ended just before lunch. The aircraft departed on the second mission carrying one passenger and 21 boxes of supplies. After making landings and takeoffs at several different locations the crew noticed that the rotor rpm would bleed off. On one approach, the rotor rpm bled off to the point that the crew made a missed approach.

On takeoff, the aircraft had to taxi back to the rear of the LZ to get enough distance to clear 5- to 10-foot obstacles. The aircraft had been into this LZ without incident once before to drop off some passengers. They had returned to pick up the passengers and the total load was now 14 boxes of supplies, baggage, 6 passengers and 4 crewmembers.

The aircraft began to lift off with the pilot at the controls. As collective was applied, the aircraft became airborne in a cloud of dust. Visual reference was lost as the aircraft climbed slowly. When they climbed above the dust, a tree was sighted to the left front of the aircraft. A right cyclic turn was started to avoid the tree and at this point the low rpm audio came on. Full left pedal was applied in an effort to keep the aircraft straight. Rotor rpm continued to bleed off as the aircraft continued a slow descending right turn. As the rotor rpm bled, the tail swung 230 degrees from the original heading and the aircraft crashed. The crew and passengers exited with no significant injuries.

This was a clear case of crew error and even poorer judgment. The UH-1H was more than 800 pounds overgross for the altitude and outside air temperature. The pilot and copilot lacked recent experience in high altitude flying and did not perform a go-no-go hover check.

USAAAVS

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, USAAAVS, Ft. Rucker, AL 36362

Nomex Gloves

Wear of Nomex flyer's gloves, especially during the summer months, causes the leather palm to harden due to perspiration. This hardening occurs normally before the gloves are worn enough to warrant exchanging them for a new pair.

Is there a softening agent available which can be applied to the gloves and not cause them to lose any of their fire-retardant characteristics? If so, what is the national stock number or its brand name if it has to be procured locally?

Nomex gloves (type GS/FRP-2, LIN J67052) are constructed of high quality leather and Nomex material. The leather palm specification was changed in 1973 to reduce the hardening problem you describe. Perhaps you have one of the older types of gloves. The washing instructions are specifically designed to aid in keeping the leather soft. They are as follows:

a. The glove may be washed with a mild soap in water not over 120 degrees F. in temperature.

b. Rinse thoroughly; then stretch into shape.

c. Drip dry or wrap into a towel. Do not wring or twist dry. Do not expose to hot air or full sunlight.

We checked with the Army Natick Research and Development Command about an acceptable leather softening agent which can be applied to the leather portion of the gloves without degrading the fire-retardant characteristics. It is felt that Neatsfoot Oil, Type I, NSN 8030-00-597-6105, should be tried. This treatment may not be 100 percent effective in softening the leather and darkening of the leather will occur. You may also try saddle soap, NSN 7930-00-170-5467, but this may or may not work.

If you continue to have this problem, please submit an Equipment Improvement Recommendation (EIR) in accordance with TM 38-750. Check your FLIGHTFAX file for Vol. 4, No. 4, dated 29 October 1975, for further information on preparing EIRs on clothing and textile items.

Maintenance of Survival Gear

I am stationed at Ft. Lewis, WA, and we have a very limited contract with the Air Force at McChord to service survival equipment. At present the contract is being enlarged but the Air Force is overloaded already and this contract will probably not be accepted.

What is being done to provide the Army with the capability of maintaining this equipment? One of the individuals in my unit was a Marine Corps safety and survival equipment mechanic, and I am sure there are more qualified personnel available.

The Army has no MOS for the repair, maintenance and inspection of aviation life support equipment (ALSE). There is no single Army source of information about ALSE doctrine, philosophy, use, proponency, maintenance, training, supply, safety, operations, etc. There is also no single office, agency or command in the Army responsible for the entire life cycle management of ALSE.

The AVSCOM life support equipment officer has initiated efforts to establish an ALSE career field, but has been unsuccessful in gaining DA approval.

Action, largely precipitated by USAAAVS, is underway to form a Management Council for Aviation Life Support Systems (ALSS). This action is designed to focus attention on problems such as yours and to provide for coordinated participation between developing agencies and user representatives in reviewing future ALSS requirements and existing ALSS adopted by Army aviation. This council is to include The Surgeon General, U.S. Army Forces Command, U.S. Army Training and Doctrine Command, and U.S. Army Materiel Development and Readiness Command. USAAAVS plans to actively participate in the functions of this council.

Now, what can you do to help resolve these longstanding and significant problem areas? You can write Commander, USAAVSCOM, ATTN: DARCOM-POLSE (Mr. A.B.C. Davis), P.O. Box 209, St. Louis, MO 63166, and tell the project officer what your unit's needs are for trained ALSE personnel in your unit. Go into as much detail as you can regarding the use of ALSE in your unit, the inspection and maintenance requirements, the number of people you have working on ALSE, the time actually required to perform required inspections and maintenance, and the skills and knowledges your unit requires to maintain safe and efficient ALSE. Explain what other areas are being short-changed in your unit because you require an individual to work in the ALSE field while he occupies a TOE slot in another career field. Unit requirements are needed to support requests for establishment of an ALSE career field. Please forward information copies of your comments to Commander, USAAAVS, ATTN: IGAR-TA, Ft. Rucker, AL 36362.

ATC action line

UNITED STATES ARMY AIR TRAFFIC CONTROL ACTIVITY

WHAT PROCEDURE(S) must be followed by an Army Aviator in Continental United States (CONUS) to obtain all appropriate Notices to Airmen (NOTAMs)?

The question appears simple, but the answer is complex because of such factors as: What is a NOTAM? Where you are departing from? Where you plan on going? What services/publications you have available for flight planning?

Before identifying specific procedures to follow, let's first look at some factors relative to NOTAMs. There are two NOTAM systems in CONUS, one operated by the Federal Aviation Administration (FAA) and the other operated by the U.S. Air Force (USAF). The FAA system does not provide NOTAM coverage on all USAF and U.S. Navy (USN) bases; likewise, the USAF system does not provide NOTAM coverage on all civil airfields. Each system utilizes different criteria for NOTAMs and different methods of dissemination. The differences in criteria have very little impact on flight planning; however, the methods of dissemination must be understood in order to know how to obtain NOTAMs from either system.

The FAA defines a Notice to Airmen as "a NOTAM containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition or change in any component (facility, service or procedure) of, or hazard in the National Airspace System, the timely knowledge of which is essential to personnel concerned with flight operations." NOTAMs are categorized as:

- *NOTAM (D)*—Time, critical information which would affect a pilot's decision to make a flight. It is disseminated over wide areas via teletypewriter.
- *NOTAM (L)*—Information which is primarily of an advisory or "nice-to-know" nature is disseminated locally via voice communications, local teletype circuits, "hot lines," telephones, etc.
- *Flight Data Center (FDC) NOTAMs*—Contain changes to FAA and U.S. Army instrument approach procedures, aeronautical charts and special flight restrictions.These are disseminated over all FAA circuits and published in the Airman's Information Manual (AIM) Part 3A. Each Flight Service Station (FSS) maintains a current list of all FDC NOTAMs disseminated after AIM Part 3A publication date.
- Other information known sufficiently in advance or NOTAMs which are in effect for extended periods of time also are published in the AIM Part 3A.

The Air Force defines a Notice to Airmen as "a notice, identified either as a NOTAM or Airmen Advisory, containing information concerning the establishment, condition, or change in any aeronautical facility, or component of service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations:

- *NOTAM*—A Notice to Airmen in message form requiring expeditious and wide dissemination by telecommunications means.
- *Airmen Advisory*—A Notice to Airmen normally only given local dissemination, during preflight or inflight briefing, or otherwise during contact with aircrews."

Temporary airfield NOTAMs and change to instrument approach procedures are disseminated via the Air Force NOTAM system. NOTAMs of extended duration are maintained on the system until published in the DOD Flight Information Publications (FLIP). FAA Flight Data Center NOTAMs also are carried on instrument approach procedures of civil airfields published in the FLIP. The airfields and extent of coverage provided by the USAF NOTAM system are identified in the IFR (instrument flight rules) Supplement.

Well—how about us—the Army? The Army has no NOTAM system but participates in both systems to satisfy requirements. NOTAMs on Army airfields are disseminated over the FAA system. In addition those Army airfields identified in the FLIP as being fully covered by the USAF NOTAM system disseminate NOTAMs via both systems. The Army Aviation Flight Information Bulletin contains permanent type data until published in the FLIP and temporary data which cannot be accommodated by FLIP or NOTAM systems on Army, Army National Guard, Army Reserve airfield/facilities. It also contains pertinent FDC NOTAMs and information on USAF/USN bases.

The chart on the next page reflects what sources should be checked to obtain all appropriate NOTAMs.

		SOURCES							
Departure	Destination	USAF NOTAM System	FAA NOTAM System	FLIP	AIM Parts 2-3-4	AIM Part 3A NOTAMS	Local NOTAMS (1)	FSS	FIB (2)
Army, USN, USAF Airfield	Civil Airfield	(3)	X	X	X	X	X	X	X
	USN, USAF Base	X		X			X		(2)
	Army Airfield	(3)	X	X		X	X	X	X
Civil Airfield	Civil Airfield		X	X	X	X	X	X	(2)
	USN, USAF Base	X		X			X		(2)
	Army Airfield		X	X		X	X	X	X

Remarks: (1) Local NOTAMs are sometimes posted on NOTAM Boards of Flight Planning Rooms. They may also be provided to Airmen by Operations Personnel, FSSs, or ATC facilities.

(2) The FIB often contains advisory information on military units that are tenants. Although not critical, the information is pertinent.

(3) Some civil and Army airfields are fully covered by the USAF system. In this case either the FAA or USAF NOTAM systems may be checked.

Note: It is realized that all of the above sources are not always available; however, there are other means to obtain NOTAM information. As a last resort, you should be aware that Government collect phone calls are authorized to FSSs and military bases listed in the IFR Supplement to obtain weather, NOTAMs and filing of flight plans. Information obtained during preflight planning can always be updated during the enroute portion of flight by contacting FSSs and/or ATC facilities. Various assistance is available; however, in the final analysis its up to you—the Aviator—to obtain it.

Air Traffic Controller Of The Year For 1976

Continued from page 28

and GCA), SSG Lewis soon was appointed an FAA examiner for the detachment and thus became one of only four dual rated FAA examiners in Europe.

Staff Sergeant Lewis communicates from the tower to a departing helicopter at Kitzingen Army Airfield

• SSG Lewis developed and pioneered the first training program in his unit which provides a means for other controllers to become dual rated. As a result of his experimental program, three controllers have been cross-trained and have received a dual rating at the detachment and five others are currently in training.

• He assisted in developing air traffic control procedures used during the 1975 Operation Reforger, a joint combat exercise involving NATO forces, which was instrumental in some 8,000 air traffic control operations being conducted during the 3-week period *without incident*.

In a letter to SSG Lewis announcing his selection, Major General Gerd S. Grombacher, commander of the USACC and Ft. Huachuca, noted: "These repeated demonstrations of outstanding performance as an air traffic controller have led to your selection as our Bicentennial Year's Controller of the Year. I am proud to have you as a member of the ATC team and again congratulate you on your truly outstanding performance of duty."

A 7-year veteran of the U.S. Army SSG Lewis was distinguished graduate of the Noncommissioned Officer Education System Advance Course with a 96.12 grade point average. At the NCO Academy at Ft. Jackson, SC, he made the commandant's list for academic achievement and soldierly excellence.

SSG Lewis will journey from Kitzingen to Ft. Huachuca, AZ., on the 23rd of this month to receive his Controller of the Year award from the USACC commander.

Fort Rucker ATC School Trains Fort Campbell Controllers

SFC Keith A. Ellefson
and
John C. Smith

ATC Advanced Branch
Deputy for Training
U. S. Army Aviation Center

UNITED STATES ARMY Communications Command (USACC) air traffic controllers are being trained at Ft. Rucker to assume the U. S. Air Force radar approach control mission this December at Ft. Campbell, KY.

Six groups—totaling 24 controllers—will have completed this specialized facility rating training by November at the Army Aviation Center, which was assigned the mission by the U. S. Army Training and Doctrine Command (TRADOC), Ft. Monroe, VA.

Air traffic control (ATC) functions and procedures within any commissioned ATC facility (tower, ground controlled approach, radar approach control) are standard, well established and time tested. It is normal to anticipate training newly arrived controllers through a local "check out" (facility rated) on-the-job, accomplished by highly qualified senior controllers. Such is not the "norm" for Ft. Campbell. Rather a unique experiment is underway to train the total complement of Army controllers to replace the existing Air Force complement to ensure an orderly transfer on the agreed date. This will be a first in that never before has the Army maintained and operated an Army radar approach control (ARAC) fully staffed with military controllers and supervisors.

Transfer of ARAC responsibilities to the Army is a complex process which requires skilled radar approach controllers capable of providing terminal arrival, departure and enroute service to both military and civil flight operations.

Ft. Campbell controllers receive practical radar approach control training at Ft. Rucker. Ft. Campbell area is simulated in data automated radar

To meet the challenge the Army Air Traffic Control School at Ft. Rucker has simulated the Ft. Campbell control area in the school's sophisticated computerized radar simulator and conventional approach control laboratories. This is part of a comprehensive training program which the ATC School began last November with the goal of providing realistic Ft. Campbell radar operations under simulated conditions.

Facility rating training at Ft. Rucker lasts 6 weeks and is divided into three phases. First the controller learns the Ft. Campbell terminal flying area to include its airways, holding patterns, navigational aids, airports and all instrument approach procedures.

The second phase teaches effective IFR (instrument flight rules) separation between arriving, departing and enroute aircraft without the use of radar. This requires the application of knowledge acquired in phase one in conjunction with the elements of time, speed, distance and altitude.

A thorough understanding and demonstrated ability of phase two is essential for two reasons. First, if the electromechanical portion of a radar ATC system fails, the approach controller must be able to convert to a nonradar system in order to continue providing IFR air traffic service. Second, nonradar approach control procedures are the framework over which radar approach control procedures are applied to enable the controller to move a greater volume of air traffic in a safe and efficient manner.

The final phase of the training places the student in the ATC School's data automated radar simulator for detailed and extensive practical application of Ft. Campbell's radar operation. The trainee works the radar approach/departure, flight data and precision approach positions. He is charged with the same airspace and controls the same types of aircraft, to include callsigns, as he will control in the Ft. Campbell facility. He trains 7 hours per day for a total of 30 training days, controlling every conceivable traffic situation, with a volume of traffic that matches or exceeds Ft. Campbell's peak operation.

The ATC School has previously furnished a similar type of radar approach control facility rating training for U. S. Marine Corps controllers from Cherry Point U. S. Marine Corps Air Station, NC. The Cherry Point training package resulted in a 50 percent reduction in controller facility rating qualification time.

The ATC School currently has data automated programs established to simulate the Ft. Campbell and Ft. Rucker ARACs and is developing data automated programs to simulate the forthcoming ARACs at Ft. Hood, TX, and Ft. Sill, OK.